DRAFT
LANDFILLS 2, 5, & 6 - CAP INSTALLATION PROJECT
WORK PLAN
FORT CARSON, COLORADO

Contract No. DACW45-93-D-0007
Delivery Order No. 0027

Prepared for:
U.S. Army Corps of Engineers
Omaha District

Prepared by:
Rust Environment & Infrastructure
Englewood, Colorado 80111

Rust Project No. 89868.400

November 1995

DISTRIBUTION LIST

	Recipients	Copies
1.	U.S. Army Corps of Engineers Omaha District ATTN: CEMRO-ED-EA (Linda White) 215 N. 17th Street Omaha, Nebraska 68102-4978	4/1[1]
2.	U.S. Army Corps of Engineers Missouri River Division (MRD) ATTN: CEMRD-ED-C (Williams) 12565 West Center Road Omaha, Nebraska 68144-3869	1
3.	U.S. Army Mr. Jim Henderson HQ Fort Carson ATTN: AFZC-E-C-M Building 302 Fort Carson, Colorado 80913-5023	2
4.	U.S. Army Corps of Engineers Missouri River Division (MRD) ATTN: CEMRD-EP-LC 420 South 18th Street Omaha, Nebraska 68102	1

[1] Document quantity includes one unbround, camera-ready copy.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Section **Page**

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

CDPHE	Colorado Department of Public Health and Environment
cm/sec	Centimeters per second
COD	Chemical oxygen demand
EPA	U.S. Environmental Protection Agency
ID	Inside diameter
OD	Outside diameter
POL	Petroleum, oil, and lubricants
PPE	Personal protective equipment
Rust	Rust Environment & Infrastructure
SSHP	Site Specific Health and Safety Plan
TOC	Total organic carbon
μg/l	Mircograms per liter
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency

1.0 INTRODUCTION

This Work Plan has been prepared by Rust Environment & Infrastructure (Rust), under contract to the U.S. Army Corps of Engineers (USACE), to outline remedial activities at Landfill 2 (FTC-006), Landfill 5 (FTC-009), and Landfill 6 (FTC-010) at the Fort Carson facility. Remedial activities described within this Work Plan address the minimization of leachate generation from each of the above referenced landfills, and will include: site characterization; installation of new caps; installation of monitoring wells; site restoration; and post construction monitoring.

This plan has been prepared to the specifications of the project's Scope of Services for Modification No. 1, dated June 27, 1994 and in accordance with U.S. Environmental Protection Agency (EPA) guidance, Colorado Department of Public Health and Environment (CDPHE) regulations, and in guidance provided by the USACE. The 30% design packages for each of the landfills, which included a set of 30% Design Drawings and a Draft Design Analysis Report, were used as a basis for this Work Plan. The Work Plan, therefore, exhibits a level of detail comparable to that of the Design Analysis. The Work Plan will be modified to describe activities at a greater level of detail upon completion of refined versions of the Design Analysis.

1.1 GENERAL FACILITY INFORMATION

Fort Carson is located in east-central Colorado, adjacent to the eastern flank of the Rocky Mountain Front Range. The installation is approximately eight miles south of Colorado Springs and 40 miles north of Pueblo, and in its entirety, occupies approximately 220 square miles.

Fort Carson is an active military training installation for both weapons qualification and field training, and is home to the 4th Infantry Division (Mechanized). The primary mission of Fort Carson is the training and readiness of all assigned and attached troops to ensure combat-readiness. The principal industrial operation at Fort Carson has been the repair and maintenance of vehicles and aircraft.

1.2 SITE DESCRIPTIONS

The following sections present a description of each landfill.

1.2.1 Landfill 2 (FTC-006)

The former Landfill 2 was reportedly operated between 1960 and 1978 as a combined trench and fill landfill, with trenches oriented perpendicular to the topographic slope. The types of waste reportedly received at this site include mixed loads of sanitary wastes, sludges, and waste petroleum, oil, and lubricants (POL). Reports from the United States Army Toxic and Hazardous Materials Agency (USATHAMA) and the United States Army Environmental Hygiene Agency (USAEHA) indicate that leachate generated from this site has apparently migrated to the groundwater. These reports state that the site contains elevated levels of Total Organic Carbon (TOC), Chemical Oxygen Demand (COD), nitrates and nitrites.

1.2.2 Landfill 5 (FTC-009)

The former Landfill 5 was reportedly operated between 1946 and 1956, and received wastes including construction debris, mixed sanitary waste, waste POL, coal cinders and ash. The method used for waste placement is unknown. Samples collected by USATHAMA at this site indicate that the landfill produces leachate which exceeds groundwater standards for iron, selenium, nitrate, and sulfate. In addition, investigations performed by the USAEHA indicate elevated levels of lead, nitrates, COD, TOC, and TDS. These findings were reported in the USAEHA 1988 Evaluation Report of Solid Waste Management Units at Fort Carson.

1.2.3 Landfill 6 (FTC-010)

The former Landfill 6 operated between 1942 and 1946 as a trench type landfill, with refuse placed in trenches, compacted by several passes of a bulldozer, and covered with locally obtained soil fill. The trenches are oriented southwest to northeast, and the types of waste reportedly received at the site included construction debris, mixed sanitary waste, sludges, and waste POL.

In the 1985 USAEHA Geohydrologic Study mentioned previously, it is reported that high concentrations of nitrates, dissolved salts, and lead were found in samples collected from wells at the landfill. The conclusion made by the USAEHA 1988 Evaluation Report of Solid Waste Management

Units at Fort Carson was that leachate containing lead and nitrates may have developed from the waste material in the landfill.

1.3 OBJECTIVES

The purpose of this Work Plan is to describe cap construction activities which will be performed in an effort to minimize the generation of leachate at each of the three landfills. The Work Plan contains a description of the activities necessary for 1) verification of design assumptions for cap construction; 2) cap construction; 3) post-construction sampling and monitoring; and 4) assessment of the effectiveness of the containment, including the need for further remedial activities. Design Analysis for each of the landfills exist as separate documents, and were used as a guideline in the preparation of this Work Plan. The Design Analysis will also be used to generate project specifications, as well as demonstrating that all regulatory requirements are met.

2.0 PROJECT DESCRIPTION

2.1 PRE-DESIGN ACTIVITIES

Several field methods were utilized to delineate the boundaries of the landfills. In conjunction with this effort, additional information was sought pertaining to the presence of landfill gas and the geotechnical characteristics which exist in soils forming the landfills and their foundations. The field methods used to help define the limit of waste and obtain information relative to assessing the presence of landfill gas and characterizing geotechnical soil parameters included:

- Field Mapping;
- Geophysical Analysis;
- Soil Gas Sampling;
- Soil Boring Drilling; and
- Groundwater Sampling.

These field methods and their respective results are discussed in detail within each specific landfill Design Analysis and a brief summary is included in the sections to follow.

2.1.1 Landfill 2 Pre-Design Activities

The existing limit of waste encompasses approximately 81 acres, based primarily on the field mapping effort performed at Landfill 2. Air photos taken on December 14, 1994 were used to assist in the field mapping effort, and to generate a topographic map which is included as Figure 1. This drawing also illustrates the limit of waste. A geophysical survey using a continuous wave electromagnetic sensor was performed to supplement field mapping efforts; however, it was not possible to differentiate between landfill materials and native soils using results of the survey.

A soil gas survey was performed at Landfill 2 to evaluate hydrogen sulfide, methane, and total organic vapor concentrations at 105 different locations. Although, the results of the soil gas survey revealed a small area with low concentrations of methane and hydrogen sulfide in localized areas, it was concluded that landfill gas is not a problem at the landfill. Results of the survey can be found on Figure 2 of the Design Analysis for Landfill 2.

The geotechnical field investigation for Landfill 2 consisted of drilling 14 exploratory borings. This work was performed to gather information on the limit of waste, and general characteristics of existing fill and native materials. Boring locations, and a summary of the materials found while drilling is included in Figure 3 of the Landfill 2 Design Analysis. The information gathered during the geotechnical field investigation was also used to perform a geotechnical evaluation of Landfill 2. The geotechnical evaluation focused on analyzing the landfill for potential settlement to ensure the proposed final grades provide for positive surface water drainage following cap construction.

In order to evaluate the potential impacts on groundwater quality at Landfill 2, six existing monitoring wells were sampled and two direct push groundwater samples were collected in May 1995, at the locations shown on Figure 6 of Landfill 2 Design Analysis. The direct push groundwater test locations were selected on the down gradient side of the landfill, and included test locations at existing drainage swales to sample flows following the natural topography. The direct push groundwater samples were collected using a hydraulic penetrometer rig, mounted on an all-terrain vehicle.

The six existing monitoring wells were purged prior to sampling to ensure that representative samples were collected. Prior to purging, the depth to groundwater was measured with an electric water level meter. In low yield wells, a single casing volume was removed, and the water level in the well was allowed to recover prior to sampling.

Results of the groundwater analyses above drinking water standards are posted on Figure 6 of the Design Analysis. The Design Analysis also includes copies of original laboratory analytical data. Organic compounds were detected only in groundwater from down gradient Well FCMW-76. 1,2-Dichloroethane was detected at a concentration of 2.9 micrograms per liter (μg/l), while 1,2 Dichloropropane was detected at a concentration of 3.8 μg/l.

Groundwater elevation contour maps for measurements collected in February and June 1995 are presented on Sheets C-6 and C-7 of the Landfill 2 Final Cap Plans. The top of the Pierre shale elevation is presented on Figure 5 of the Landfill 2 Design Analysis. Water table contours appear to follow the slope of the top of Pierre in both winter and summer. The water table is generally below

the bottom of the landfilled materials and often is located within the upper portions of the Pierre Shale.

2.1.2 Landfill 5 Pre-Design Activities

The field mapping task at Landfill 5 was only partially effective, due to the fact that grading has obscured the limit of waste along the north boundary, and the western limit of waste is believed to exist under the parking lot south of Building 8930. Some success in delineating the limit of waste was realized while mapping along the B-ditch which borders the landfill on the south and east sides. Field mapping was aided by the availability of site topography maps, which were prepared from air photos of the site taken of December 14, 1994. Figure 2 presents the topographic map and the estimated limit of waste. A geophysical survey using a continuous wave electromagnetic sensor was performed to supplement field mapping efforts; however, it was not possible to differentiate between landfill materials and native soils using results of the survey.

The soil gas survey for Landfill 5 consisted of collecting and analyzing samples from 53 different locations. This survey revealed concentrations of methane and hydrogen sulfide which are not considered to be problematic. Results of the soil gas survey can be found in Figure 2 of the Design Analysis for Landfill 5. A geotechnical field investigation was performed in order to gather information on the limit of waste, as well as the general characteristics of existing fill and native materials. This investigation consisted of drilling and logging 13 exploratory borings at the locations shown on Figure 3 of the Design Analysis for Landfill 5. Logs of exploratory borings are presented in Appendix B of the aforementioned document. Results and interpretations of information gathered during the geotechnical field investigation were utilized to determine the limit of waste, and in geotechnical calculations presented in the Design Analysis.

In order to evaluate the potential impacts on groundwater quality at Landfill 5, eight existing monitoring wells were sampled and two direct push groundwater samples were collected in May 1995 in locations shown on Figure 6 of the Landfill 5 Design Analysis. The direct push groundwater test locations were selected on the down gradient side of each site, predominantly between the known limit of waste and the B-ditch or the Post boundary.

The eight existing monitoring wells were purged prior to sampling to ensure that representative samples were collected. Prior to purging, the depth to groundwater was measured with an electric water level meter. The purge rates were minimized in order to minimize sample turbidity. In low yield wells, a single casing volume was removed, and the water level in the well was allowed to recover prior to sampling. Results of the groundwater analyses above drinking water standards for Landfill 5 are posted on Figure 6 of the Design Analysis. Organic parameters were detected above drinking water standards only in groundwater from Well FCMW-82 with a single detection of trichloroethane at a concentration of 5.4 μg/l.

Groundwater elevation contour maps for measurements collected in April and June 1995 are presented on Sheets C-7 and C-8 of the Landfill 5 Final Cap Plans, and the top of Pierre Shale elevation is presented in Figure 5 of the Landfill 5 Design Analysis. The water table generally follows the slope of the top of the Pierre Shale to the south and east. The water table, in both winter and summer, is below the base of landfill materials and within the upper portion of the Pierre Shale.

2.1.3 Landfill 6 Pre-Design Activities

The field mapping effort at Landfill 6 was not effective since the landfill area has been graded flat, essentially obscuring the limit of waste. A geophysical survey of the area was also performed to define the location of the outer perimeter of the landfill, and thereby determining the extent of landfill to be capped. The geophysical survey was conducted using a continuous wave electromagnetic sensor which was deployed on a series of 24 parallel survey lines along a north-south orientation. Results of the survey were inconclusive as the sensor could not produce sufficient information to differentiate between landfill materials and native soils. The limit of waste has, therefore, been approximated based on observations made while drilling soil borings. The limit of waste is estimated to be approximately 13 acres, and is shown on Figure 3. This sheet also depicts the site topography which was prepared from air photos taken on December 14, 1994.

The soil gas survey for Landfill 6 consisted of collecting and analyzing samples from 26 different locations. This survey revealed concentrations of methane and hydrogen sulfide which are not considered to be problematic. Results of the soil gas survey can be found in Figure 2 of the Design Analysis for Landfill 6. A geotechnical field investigation was performed in order to gather

information on the limit of waste, as well as the general characteristics of existing fill and native materials. This investigation consisted of drilling and logging six exploratory borings at the locations shown on Figure 3 of the Design Analysis for Landfill 6. Logs of exploratory borings are presented in Appendix B of the aforementioned document. Results and interpretations of information gathered during the geotechnical field investigation were utilized to determine the limit of waste, and in geotechnical calculations presented in the Design Analysis.

In order to determine the potential impacts on groundwater quality, existing monitoring wells were sampled and direct push groundwater samples were collected. Three wells and four direct push locations were sampled at the locations shown on Figure 6 of the Design Analysis for Landfill 6. Analytical data is presented in Appendix H of the Design Analysis.

The direct push groundwater locations were selected on the down gradient edge of the landfill between Well LF-6A and the drainage ditches/channels. The direct push groundwater samples were collected using a hydraulic penetrometer rig, mounted on an all-terrain vehicle.

The three existing monitoring wells were purged prior to sampling to ensure that representative samples were collected. Prior to purging, the depth to groundwater was measured with an electric water level meter. In low yield wells, a single casing volume was removed and the water level in the well was allowed to recover prior to sampling.

Results of the Groundwater analyses are posted on Figure 6 of the Design Analysis, and copies of the original laboratory analytical data are presented in Appendix H of the same document. Organic parameters were detected above drinking water standards only in groundwater from location LF6-A. Tetrachloroethene, trichloroethene, and vinyl chloride were detected at concentrations of 34, 9.4, and 65 micrograms per liter, respectively.

Groundwater elevation contour maps for measurements collected in February and June 1995 are presented in Sheets C-7 and C-8 of the Design Drawings. The water table appears to be above the top of the Pierre Shale, and within the landfill material itself. Due to this fact, additional direct push sampling and monitoring well installation activities are planned.

2.2 WORK ACTIVITIES

In order to define the scope of work, four major tasks have been developed including site preparation, cap installation, well installation, and post-construction monitoring. The sections to follow outline each of these activities.

2.2.1 Mobilization and Site Preparation

The site preparation task will establish the work area in a safe and environmentally protective manner. The key elements of the site preparation include the following:

- Grading, drainage, and surfacing of the storage area, operations support area, and access roads to provide all-weather access.
- Containment of the equipment decontamination, gross personnel decontamination, and storage areas where wastes have a potential for accidental release.
- Tapping the existing utilities to provide electricity for site operational functions.
- Providing temporary sanitary sewer facilities and a holding tank for the operations support area.
- Development of a borrow area as a source of material for earthfill.

2.2.2 Cap Installation

Actual cap construction activities will be carried out using standard earth moving and grading equipment. The handling of materials for capping will be conducted in a safe and reliable manner,such that the movement process operates efficiently under cold weather conditions. Relocation of soils and placement of cap materials will be accomplished using conventional excavation and backfill techniques and as specified by the Site Specific Health and Safety Plan (SSHP). The key elements of cap construction include:

- Delineation of cap boundaries;
- Preliminary grading;
- Placement of cap materials;
- Compaction testing;
- Final grading; and
- Vegetation restoration.

2.2.3 Well Installation

In addition to construction related activities, the cap installation task includes the plugging of existing wells and collection of ground water direct push samples prior to actual construction activities. Additional monitoring wells will be installed to help determine the effectiveness of cap installation activities. Well installation activities will include.

- Well drilling
- Well installation and development
- Surveying of well locations

2.2.4 Post-Construction Monitoring

Groundwater sampling will commence following completion of all construction activities. The locations and frequency of sampling events is detailed in Appendix D - Chemical Data Quality Management Plan. Data collected from these sampling events will be used to evaluate the need for further remedial activities at the landfills, such as the installation of a slurry wall.

3.0 SCOPE OF SERVICES

The following sections present more detailed discussion of the activities included in each major task for the installation of caps at Landfills 2, 5, and 6.

3.1 MOBILIZATION AND SITE PREPARATION

Upon a notice to proceed from USACE, the vendor information developed during the final design and estimate will be used to identify the sources of any long-delivery items. Purchase requisitions will be prepared for the procurement packages and competitive bids will be solicited for all materials and equipment. In order to deliver equipment and materials to the site in time for its immediate use, the procurement phase will lead the site mobilization by three to five weeks.

Mobilization will begin with the placement of an administrative trailer at the contractors yard. One self-contained decontamination/break trailer will also be mobilized initially to Landfill 5, and moved as work proceeds from one landfill to another. Three connex boxes will also be utilized for storage activities. One connex will be used for health and safety supplies and one will be used for tool storage. The third connex will be used for personnel decontamination and equipment storage when work is being performed at a location outside the vicinity of the self-contained decontamination trailer. Sites will be prepared at each of the landfills to set up the operations support areas. Any required modifications to access roads will be made, and additional security fence will be installed, if necessary.

Construction equipment to be used will be equipped with air bottle racks and shields, if required, and transported to the site. All equipment will be inspected upon arrival at the site to ensure it is in proper working order and free of contamination. Mobilization activities will be coordinated with Fort Carson personnel with respect to schedule and transportation routes on site.

Health and safety equipment and supplies will also be transported to the site. Required monitoring equipment will be set up outside the exclusion zone. Prior to any personnel entering fenced areas, site-specific orientation and training will be conducted. This will include facility and project rules and

requirements, project objectives, health and safety issues, personal protective equipment (PPE) requirements, and emergency protocols.

3.2 LANDFILL 2 - CAP CONSTRUCTION

In the course of establishing the limit of waste in pre-design activities, areas of the landfill which would present a significant operational problem in placing and compacting a landfill cap were identified. These areas were targeted for waste relocation to the interior of the landfill, and include the eastern areas outside of the perimeter surface water channel, and the slope north of the surface water collection channel in the northern part of the site.

During pre-design activities, it was also determined that a portion of the landfill possessed sufficient cover materials to act as a cap. This area of the landfill will be further characterized to fully determine the adequacy of the existing soil cover, and to locate areas of soil cover which may be deficient. Trenches will be excavated to confirm the extent of landfill materials in areas where the existing cap will be utilized.

3.2.1 Confirmation of Cap Extent

The first activity to be performed at each of the landfills will be a general survey to delineate the areas to be capped. Sheet C-5 of the Final Cap Plans for Landfill 2 will be used as a guideline in marking cap perimeters. Pre-construction activities at Landfill 2 will also include the installation of 19 trenches to confirm the extent of landfill materials. Trenches shall be installed to a depth determined by the depth of cover materials observed during boring operations, or until native residual bedrock is encountered. Trenches will be excavated with a backhoe, and will be typically the width of the backhoe bucket. Trenching will be begin at a distance radially outward from the suspected landfill perimeter, and proceed inward until waste materials are encountered. Trenches will be immediately backfilled as the excavation proceeds toward the landfill perimeter, thus eliminating the hazard of an open trench.

3.2.2 Existing Cover Characterization/Augmentation

Cap construction activities for Landfill 2 include the characterization of existing cover materials. Approximately 43 acres of the landfill appear to have sufficient cover over the waste to act as a cap.

Soil borings performed during pre-design activities indicate that a minimum of 3 feet of general soils overly approximately 2 feet of clay material. In addition, permeability results of cover samples were found to be within the desired range. Permeability results and boring logs are presented in Appendix B of the Landfill 2 Design Analysis.

Since the approach for Landfill 2 is to use the existing cover over approximately 43 acres of the site, a grid system to verify the thickness and permeability of actual cover soils in-place has been developed and is shown Sheet C-10 of the conceptual design plans. The grid system and corresponding testing program has been developed because the initial drilling and permeability testing was a rather cursory check of cover conditions at the landfill.

A total of 29 borings will be drilled for the existing cover verification. All borings will be advanced using 3 1/4-inch inside diameter (ID), 6-inch outside diameter (OD) hollow stem augers. A detailed boring log will be prepared from materials collected by two methods:

(1) Drive sampling using split-spoon sampler; and
(2) Push sampling using Shelby tube samplers.

Drive sampling shall be performed using a 24-inch long, 1 3/8-inch ID and 2-inch OD standard penetration test split-spoon sampler driven by a 140 pound hammer free-falling from 30 inches, in accordance with ASTM method D1586. Split-spoon samples will be retained in labeled plastic bags. Push sampling shall be performed using 3-inch O.D. by 30-inch long Shelby tubes handled in accordance with ASTM method D1587. Following the collection of each Shelby tube sample, both ends will be sealed with wax, any void space filled with silica sand, then both ends taped and capped prior to transport from the drill site.

Soil cuttings from borings shall be contained in labeled and sealed drums, and shall be removed by Fort Carson Personnel. All borings will be grouted to the surface via the Tremie method using bentonite grout slurry. Upon completion of drilling work at the landfill, the drill rig, augers, and tools will be decontaminated using a steam cleaner.

Testing of the barrier component layer shall include one of each of the following tests per borehole:

1) Grain size with hydrometer ASTM D422;
2) Atterberg limits ASTM D4318;
3) Soil classification ASTM D2487;
4) *In situ* unit weight (no ASTM);
5) *In situ* moisture content ASTM D2216; and
6) Permeability ASTM D5084, (shipped in accordance with ASTM D4220).

Upon completion of all sampling activities, a report summarizing the date will be prepared and will include:

1) Survey locations of each borehole (mapped on a scale 1"=200');
2) Procedures used to drill, sample, log, and test;
3) Logs for each hole;
4) Lab data sheets for all testing, including Shelby tube extrusion logs; and
5) Written summary of all work and results (including tables of lab results).

An additional report shall be prepared subsequent to the lab testing program to summarize the locations for reworking cover soils. As part of this effort, design drawings and supplemental specifications shall be prepared, as necessary.

For costing purposes, it has been assumed that 20 acres of the 43 acres will have to be reworked. The criteria for reworking is the thickness and permeability of the existing cover. A deficiency in any of the following requirements will necessitate stripping the existing cover soils and reworking the area.

1) Minimum of 2 feet of cohesive soils;
2) Cohesive soils to have minimum permeability of $5x10^{-7}$ centimeters per second (cm/sec); and
3) Minimum of 30 inches of protective soil covering the cohesive layer.

Reworking activities will be dependent upon the specific deficiency, but will generally consist of placing additional soils to meet above criteria.

3.2.3 Well Plugging

Prior to placement of any cap components, four monitoring wells which exist within the perimeter of the proposed cap will be abandoned and plugged. Two of the four wells will be abandoned and

plugged only if the existing cap in the vicinity of these wells requires reworking. Locations of wells to be abandoned and plugged are shown on Sheet C-8 of the Final Cap Plans for Landfill 2.

The plugging and sealing of wells is necessary to prevent contamination of ground water and the migration of water through unused boreholes. Plugging procedures will be performed per the abandonment standards of the Colorado State Engineers Office, and will generally consist of filling wells with either clean sand or gravel to the static water level, then with chemically inert materials to the ground surface. A permanent watertight cover shall be installed at the top of the casing. Unless required for grading operations, surface casings and well covers will be left in place. Plugging procedures are described in detail within the project specifications.

3.2.4 Direct Push Sampling

A total of seven direct push groundwater samples will be collected in the southeastern portion of the landfill to evaluate the presence of volatile organic compounds (VOCs) in Well FCMW-76. Sampling locations are shown on Sheet C-8 of the Design Drawings for Landfill 2. The results of analyses of the direct push water samples will be used in addition to the previous investigation results to locate two permanent monitoring well locations in the vicinity of FCMW-76.

The purpose of direct push water sampling is to screen for organic contaminants that may have impacted shallow groundwater in a discrete portion of the landfill. The direct push groundwater samples will be collected using a hydraulic penetrometer rig, mounted on an all-terrain vehicle. One-inch diameter probing rods with attached hardened steel expendable points will be hydraulically driven to just below the water table based on water level measurements from existing wells. Polyflow (polyethylene and polybutylene) tubing, perforated to correspond to the depth of the water-bearing zone, will then be inserted into the rod and screwed into the expendable point. The rods will then be retracted to expose the perforations, allowing water to flow into the tubing. The water sample will obtained with a peristaltic pump or an inertia valve. When auger refusal occurs prior to reaching groundwater, an additional attempt will be made to collect a groundwater sample by moving a few feet away and redriving. Sampling procedures are further defined in the Chemical Data Quality Management Plan - Appendix D, and the project specifications.

3.2.5 Waste Consolidation

Prior to actual earthwork at the site, temporary erosion controls shall be positioned around the work areas in accordance with the plans and specifications. It is estimated that approximately 67,500 cubic yards of material will be relocated to the central portion of the landfill. The area of the landfill which will receive consolidated fill from those areas being stripped of waste fill equals approximately 33 acres. This area comprises the entire portion of the landfill to receive a new cap. Excavation and placement of the waste fill will be carried out with standard excavation equipment.

3.2.6 Placement of New Cap

Cap construction will begin with the placement of a barrier layer which consists of cohesive soils with an in-place permeability of $5x10^{-7}$ cm/sec or less. The barrier layer shall have a minimum thickness of 24 inches. The cohesive soils will be obtained from the borrow stockpile located at the southwest corner of the landfill, and will be placed using standard earthmoving equipment. The cohesive soils will be evenly spread over the cap working face, moisture conditioned (if necessary), and compacted with appropriate equipment, such as sheepsfoot compactors. When barrier layer installation is complete, placement of the frost protection layer will begin. The frost protection layer will consist of miscellaneous soils and will have a minimum thickness of 30 inches. The soils for the frost protection layer will be obtained from the borrow stockpile and will be placed using standard earthmoving equipment.

Gradation and proctor testing will be performed on representative soil samples prior to placement. During the placement of each layer, testing for moisture content and density will be performed, as will permeability testing. Following the placement of each layer, depth (thickness) verification testing will be performed. These testing procedures are described in detail in the Construction Quality Assurance Plan (Appendix E) and the USACE project specifications. Essentially no excess gradefill (other than relocated waste) is expected to be required prior to placement of cap materials, which have been estimated to include of 105,000 cubic yards of low permeability materials, and 140,000 cubic yards of soil cover materials.

3.2.7 Monitor Well Installation

Monitoring wells will be installed to assist in defining ground water flow rates and direction, aquifer characteristics, and to assist in delineating the extent of groundwater contamination. Monitoring wells will generally be drilled to the top of unweathered bedrock (Pierre Shale). Well drilling, installation and development procedures are described in the Field Laboratory Procedure Manual dated September 1995, and in the project specifications.

At the completion of cap construction, eleven new wells will be installed. The placement of two monitoring wells will be determined by the results of direct push sampling activities. These wells will be located down gradient of FCMW-75 and FCMW-76. In addition, two monitoring wells will be installed north or upgradient of the landfill, one well will be installed to the east of FCMW-81 as a replacement well, and six wells will be installed along the western edge of the landfill to evaluate possible impacts from the former grit/oil pits. Monitoring well locations will be approved by the USACE-Technical Manager prior to installation.

3.3 LANDFILL 5 - CAP CONSTRUCTION

The capping of Landfill 5 will incorporate a soil cap, in addition to the construction of a parking lot area/asphalt cap to the south-southeast of Building 8930. The conceptual design calls for the remaining portions of the landfill to be regraded to promote surface drainage, and consolidating the limits of waste in order to minimize the amount of structural fill required to reach grade elevations. Construction activities also include the relocation of the existing tank trail such that it passes to the exterior of the parking lot area/asphalt cap.

3.3.1 Confirmation of Cap Extent

The first activity to be performed at Landfill 5 will be a general survey to delineate the areas to be capped. Sheet C-5 of the Final Cap Plans for Landfill 5 will be used as a guideline in marking cap perimeters. Pre-construction activities at Landfill 5 include the excavation of eight trenches to confirm the extent of landfill materials in the area proposed for the asphalt cap, including approximately one acre of the existing parking area that appears to contain waste materials. The procedures outlined in section 3.2.1 shall be followed for the trench excavation task. Trench locations are depicted in Figure 2.

3.3.2 Well Plugging

Prior to placement of any cap components, seven wells which exist in the area proposed for the asphalt cap, the soil cap, or in the areas proposed for consolidation will be abandoned and plugged. Locations of wells to be plugged are shown on Sheet 9 of the Design Drawings for Landfill 5. Well abandonment and plugging shall follow the procedures outlined in Section 3.2.3 and the project specifications.

3.3.3 Direct Push Sampling

A total of six direct push groundwater samples will be collected in the southeastern portion of the landfill to evaluate the presence of VOCs in well FCMW-82. The results of analyses of the direct push water samples will be used in addition to the previous investigation results to locate two permanent monitoring well locations in the vicinity of FCMW-82.

The direct push sampling method and analytical requirements are outlined in Section 3.2.4, and the Chemical Data Quality Management Plan - Appendix D.

3.3.4 Waste Consolidation

Prior to actual earthwork at the site, temporary erosion controls shall be positioned around the work areas in accordance with the plans and specifications. Approximately 107,700 cubic yards of surface debris from the eastern and southern portions of the landfill will be consolidated in the area proposed for the asphalt and soil cap as gradefill. Excavation and placement of waste fill will be carried out with standard excavation equipment, such as trackhoe excavators and trucks, and regrading of excavated areas will be performed as depicted in Sheet C-11 of the Design Drawings for Landfill 5.

3.3.5 Placement of Soil Cap

The soil cap for Landfill 5 has the same profile as described for the Landfill 2 cap. The soil cap generally consists of a 24" barrier layer and a 30" frost protection layer. The cap components, placement methods, and testing parameters are described in Section 3.2.6. It is estimated that 23,600 cubic yards of low permeability materials and 29,400 cubic yards of soil cover materials will be required for the installation of the new cap for Landfill 5.

3.3.6 Placement of Asphalt Cap

Following placement and grading of the consolidated materials, the entire area proposed for the asphalt cap will be covered with a 40-mil geomembrane liner. Once in place, a nonwoven geotextile cushion layer will be placed over the geomembrane for protection. Deployment, attachment, and testing of these materials is defined in the project specifications. The geomembrane and geotextile cushion will then be overlain with 18 inches of road base gravel. The gravel will ultimately be covered with a 6 inch thick layer of asphalt; however, the asphalt may not be placed at the time of construction due to funding limitations.

Prior to placement of cap materials, the bearing ratio of the subgrade will be checked using procedures outlined in the Construction Quality Assurance Plan-Appendix E. All cap materials shall meet the standards outlined in the Design Drawings and project specifications.

3.3.7 Monitor Well Installation

At the completion of cap construction, seven new wells will be installed. The placement of two monitoring wells will be determined by the results of direct push sampling activities. These wells will be located in the vicinity of FCMW-82. Five additional wells will be installed at Landfill 5. One well will be installed as an upgradient monitoring point along the northern edge of the landfill. Three additional wells will be located near FCMW-83/85, FCMW-82, and MW-2 as replacement wells. One well will be located in the central portion of the landfill, south of the asphalt cap. Sheet C-9 of the Final Cap Plans for Landfill 5 presents the locations of new monitoring wells to be installed.

Well drilling, installation, and development procedures are described in the Field Laboratory Procedure Manual previously mentioned in Section 3.2.7. Monitoring well locations will be approved by the USACE-Technical Manager prior to installation.

3.4 LANDFILL 6 - CAP CONSTRUCTION

Landfill 6 appears to consist of soil fill with some minor amounts of construction and municipal waste mixed within the soil fill matrix. Boring log information supports a conclusion that soil fill containing waste may exist across the entire general area of Landfill 6. Therefore, the general region forming Landfill 6 is considered to be landfill requiring capping.

Trenching will be performed prior to actual cap construction in order to identify if waste materials were used to form the slope face of the ditches and channels which surround the landfill, and to identify if waste materials exist beyond the chosen limit of waste along the north side of the landfill. In the event that the material is found to contain waste, this material will either be excavated and deposited to the interior of the landfill and replaced with non-waste soil backfill or, the slope face or area(s) containing waste will be capped with a barrier material such as asphalt or concrete. Any excavated materials placed to the landfill interior for later capping will be used as grade fill. Procedures for handling wastes are described in the Waste Management Plan (Appendix C).

3.4.1 Confirmation of Cap Extent

A total of 13 trenches will be installed using the method defined in section 3.2.1, trench locations are depicted in Sheet C-5 of the design drawings.

3.4.2 Well Plugging

Wells which exist within the area proposed for the new cap will be plugged as described in Section 3.2.3. Well locations are shown in Sheet C-9.

3.4.3 Waste Consolidation

Prior to actual earthwork at the site, temproary erosion controls shall be positioned around the work areas in accordance with the plans and specifications. It is estimated that 24,200 cubic yards of materials from the edges of the landfill will be relocated to the landfill interior. Relocation shall be performed using standard excavation procedures and equipment.

3.4.4 Placement of Soil Cap

The Landfill 6 cap design generally consists of a 24" barrier layer and a 30" frost protection layer. The cap components, placement methods, and testing parameters are described in Section 3.2.6. It is estimated that 44,700 cubic yards of low permeability materials and 49,500 cubic yards of soil cover materials will be required for the installation of the new cap for Landfill 6.

3.5 REVEGETATION

After final grading is complete, the landfill sites and borrow areas will be revegetated using grasses native to the area in accordance with a specification to be developed and coordinated with the U.S. Fish and Wildlife Service. Grasses selected shall discourage burrowing animals from using the sites as habitat. Seeding will be accomplished be means of either conventional planting equipment or hydro mulching, in accordance with the specifications. Vegetative growth will be monitored for a specific period of time, with irrigation and/or supplemental seeding and vegetation maintenance as dictated in the construction specifications.

3.6 DEMOBILIZATION

Demobilization will occur throughout the project as various activities are completed and equipment is no longer needed. All equipment leaving the site will be decontaminated by steam cleaning. Waste materials will be containerized for temporary storage and transportation to the disposal site. All unused materials and supplies will be returned for credit or stored for use on other Fort Carson projects. Government furnished equipment will be returned to storage at Fort Carson. All disturbed areas will be graded and revegetated as described above after being vacated. Demobilization activities will be coordinated closely with Fort Carson Personnel with respect to schedule and transportation routes of Fort Carson.

4.0 PROJECT SCHEDULE

The project schedule is currently under development, and will submitted with the 90% design.

5.0 PROJECT ORGANIZATION

The project organization for the procurement and construction activities is shown in Figure 4. The task organization is consistent with the overall project organization.

6.0 REFERENCES

Colorado Rules and Regulations for Water Well Construction and Pump Installation; Colorado State Engineer's Office , Board of Examiners of Water Well Construction and Pump Installation Contractors, Division of Water Resources, July 22, 1988.

Rust Environment and Infrastructure, Conceptual (30%) Design Analysis - Landfill 2, November 1995.

Rust Environment and Infrastructure, Conceptual (30%) Design Analysis - Landfill 5, November 1995.

Rust Environment and Infrastructure, Conceptual (30%) Design Analysis - Landfill 6, November 1995.

Rust Environment and Infrastructure, Former Vapor Degreaser Soil Vapor Extraction System Installation Work Plan, October 1995.

U.S. Army Corps of Engineers, October 1, 1994, "Chemical Data Quality Management for Hazardous Waste Remedial Activities, Appendix D: Guide to the Preparation of the Chemical Data Acquisition Plan." USACE ER-1110-1-263.

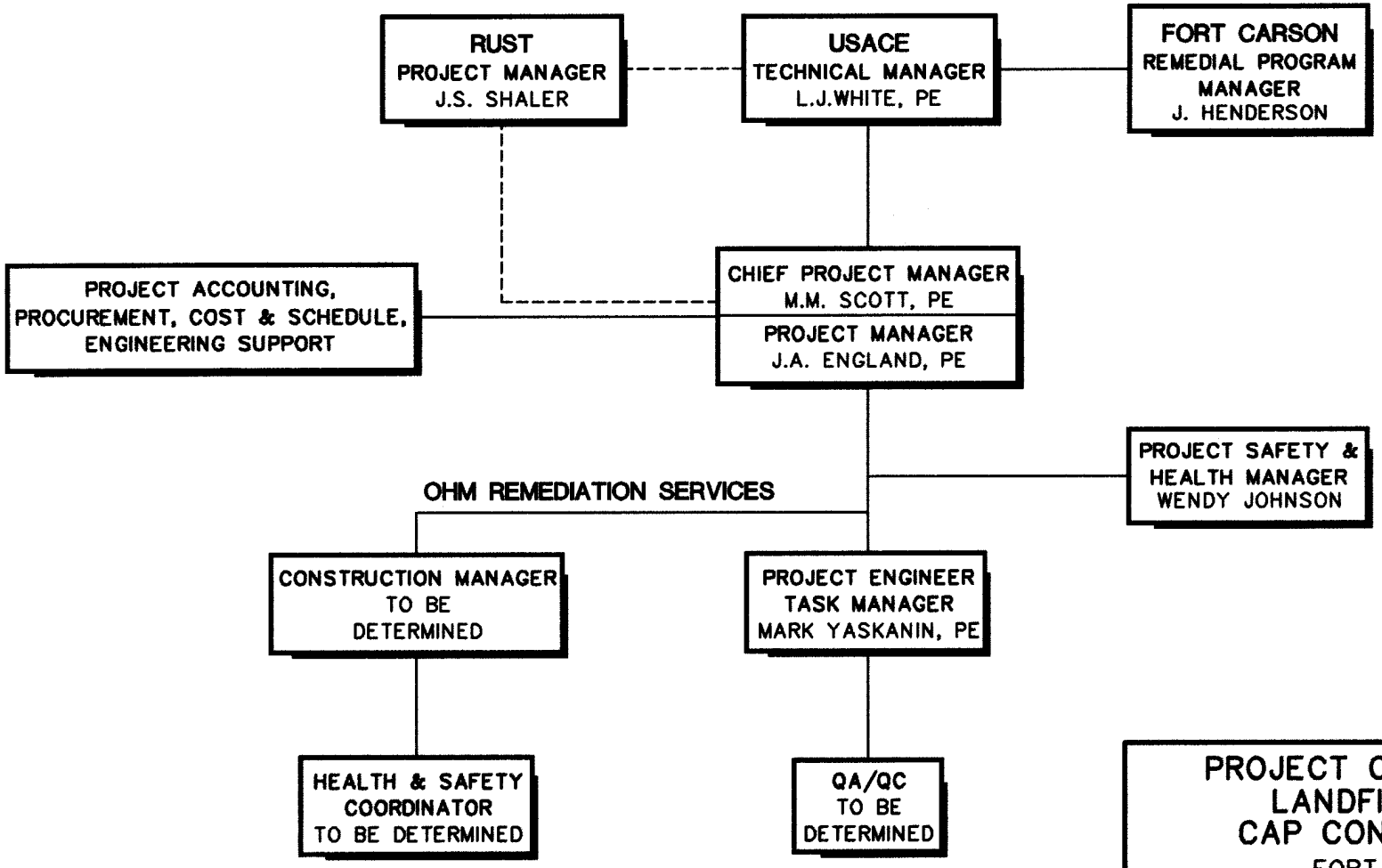
U.S. EPA, 1987, Data Quality Objectives for Remedial Response Activities, Development Process, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, EPA/540/G-87/003.

USAEHA Geohydrologic Study (Phase 2 Geohydrologic Study #38-26-0392-87), August 1985

USAEHA Groundwater Quality Study #38-26-0897-89, Investigation of Closed Landfills, June 1995

FIGURES

CHECKED BY	APPROVED BY	DRAWN BY EMH	DATE 11\14\95	FILE NAMEFTCARSON\ORGCHART.DWG	REVISION NO. 0

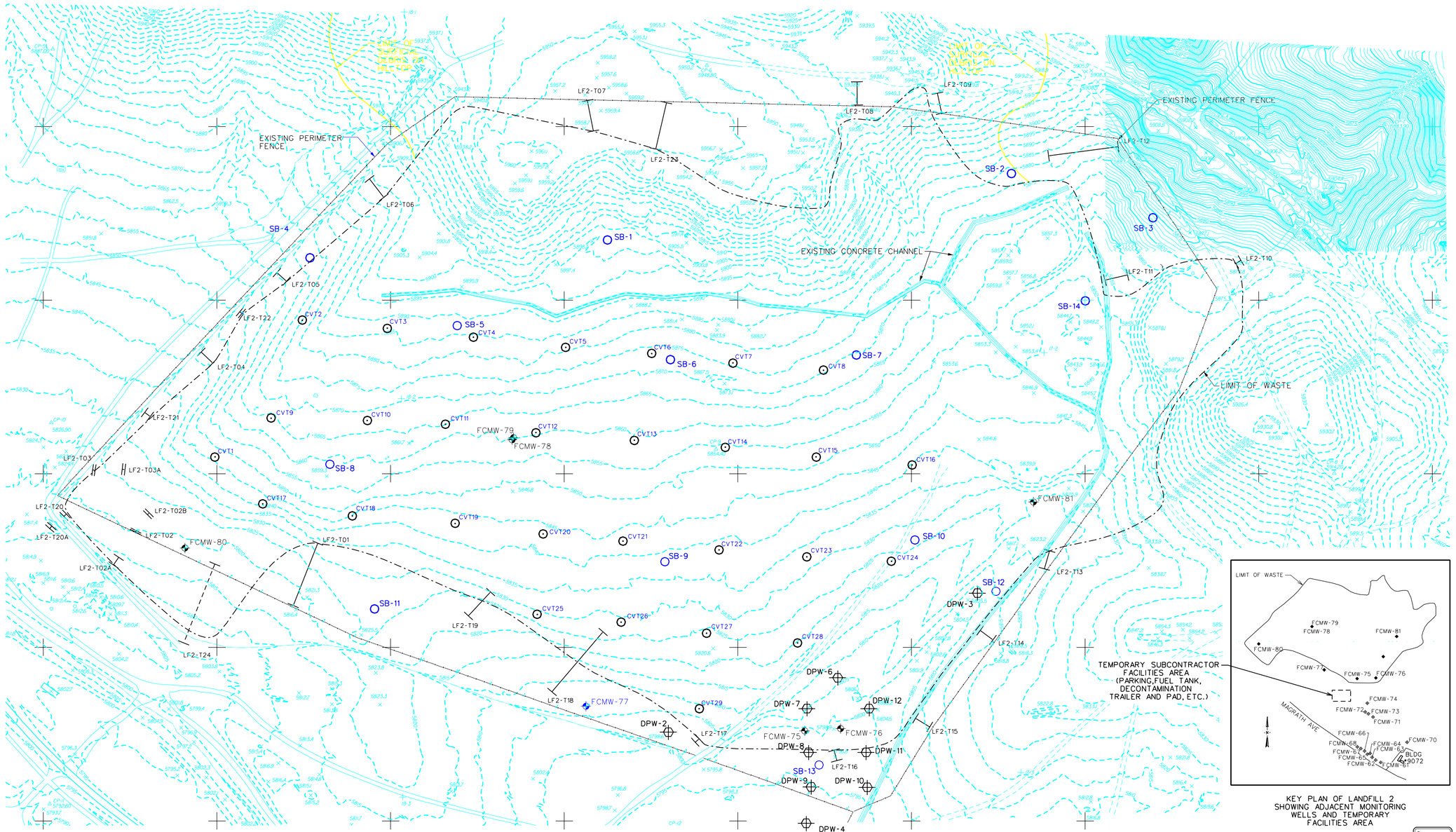


PROJECT ORGANIZATION
LANDFILL 2,5&6
CAP CONSTRUCTION

FORT CARSON
COLORADO SPRINGS, COLORADO

PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS

RUST ENVIRONMENT & INFRASTRUCTURE



LEGEND

- DPW-4 — APPROXIMATE DIRECT PUSH WATER SAMPLING LOCATION
- FCMW-81 — LOCATION OF EXISTING MONITORING WELL
- SB-3 — LOCATION OF GEOTECHNICAL BORING
- CVT-1 — LOCATION OF CAP VERIFICATION TEST BORING
- LIMIT OF WASTE
- LIMIT OF SURFICIAL DEBRIS ON HILLTOP
- SURVEY CONTROL POINT
- TRENCH LOCATION

N

NOTES:

1. NO KNOWN UTILITIES EXIST WITHIN THE AREA OF THE DRAWING SHOWN.
2. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

SCALE: 1 INCH = 200 FEET
100' 0 100'

KEY PLAN OF LANDFILL 2 SHOWING ADJACENT MONITORING WELLS AND TEMPORARY FACILITIES AREA

CAD FILE: L:\WORK\29188\CAD\FTCARSON\LF2\LANDFL2\LF2EXCON.DGN

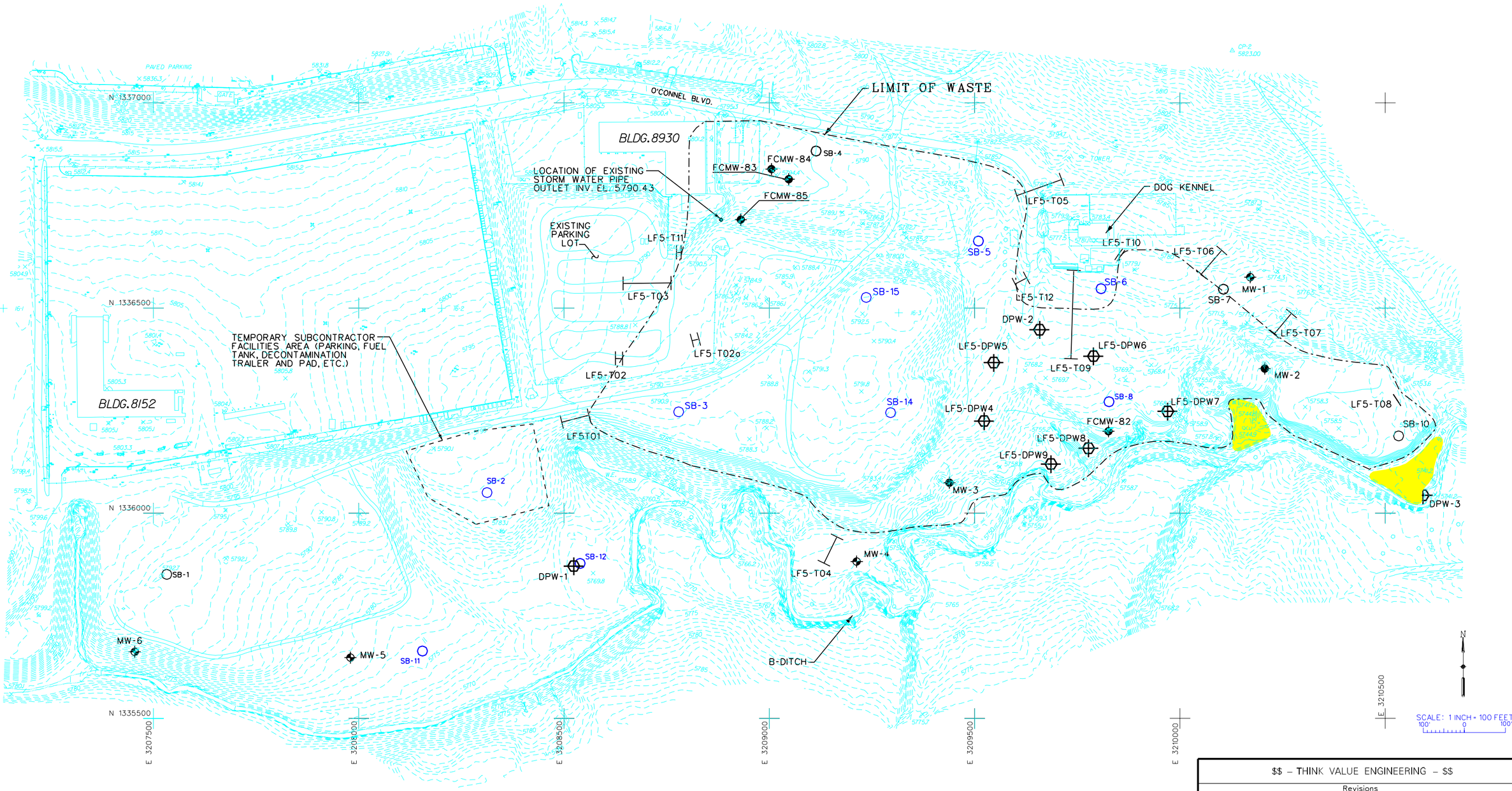
COMPUTER AIDED DESIGN & DRAFTING

$$ – THINK VALUE ENGINEERING – $$

Revisions			
Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MF	FORT CARSON	COLORADO
Drawn by: PB	**FIGURE 2**	
Checked by: MY	**EXISTING CONDITIONS**	
Reviewed by: JE	LANDFILL No.2 (FTC-006)	
Submitted by:	Plot Scale Ratio:	Date: JANUARY 1998
	Design File: LF2EXCON.DGN	Sheet reference number:
	Spec. No.: DACW 45	Drawing Code:
	Contract No.: DACW 45	



NOTE:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.

   DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

   PHOTO SCALE: 1:3960'

2. THE LIMIT OF WASTE WAS ENCOUNTERED AT THE SOUTHERN LIMIT OF TRENCH LF5-T09. HOWEVER, BASED ON INFORMATION OBTAINED FROM TRENCHES LF5-T10 AND LF5-T12, AND THE PRESENCE OF NON-WASTE SOIL FILL WITHIN TRENCH LF5-T09, THE LIMIT OF WASTE IS INTERPRETED AS SHOWN.

LEGEND

- LOCATION OF BORING
- FCMW-84 — LOCATION OF EXISTING MONITORING WELL
- LOCATION OF ABANDONED MONITORING WELL
- DIRECT PUSH WATER SAMPLE LOCATION
- TRENCH LOCATION
- CONTOUR INTERVAL IS 1 FOOT

COMPUTER AIDED DESIGN & DRAFTING

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

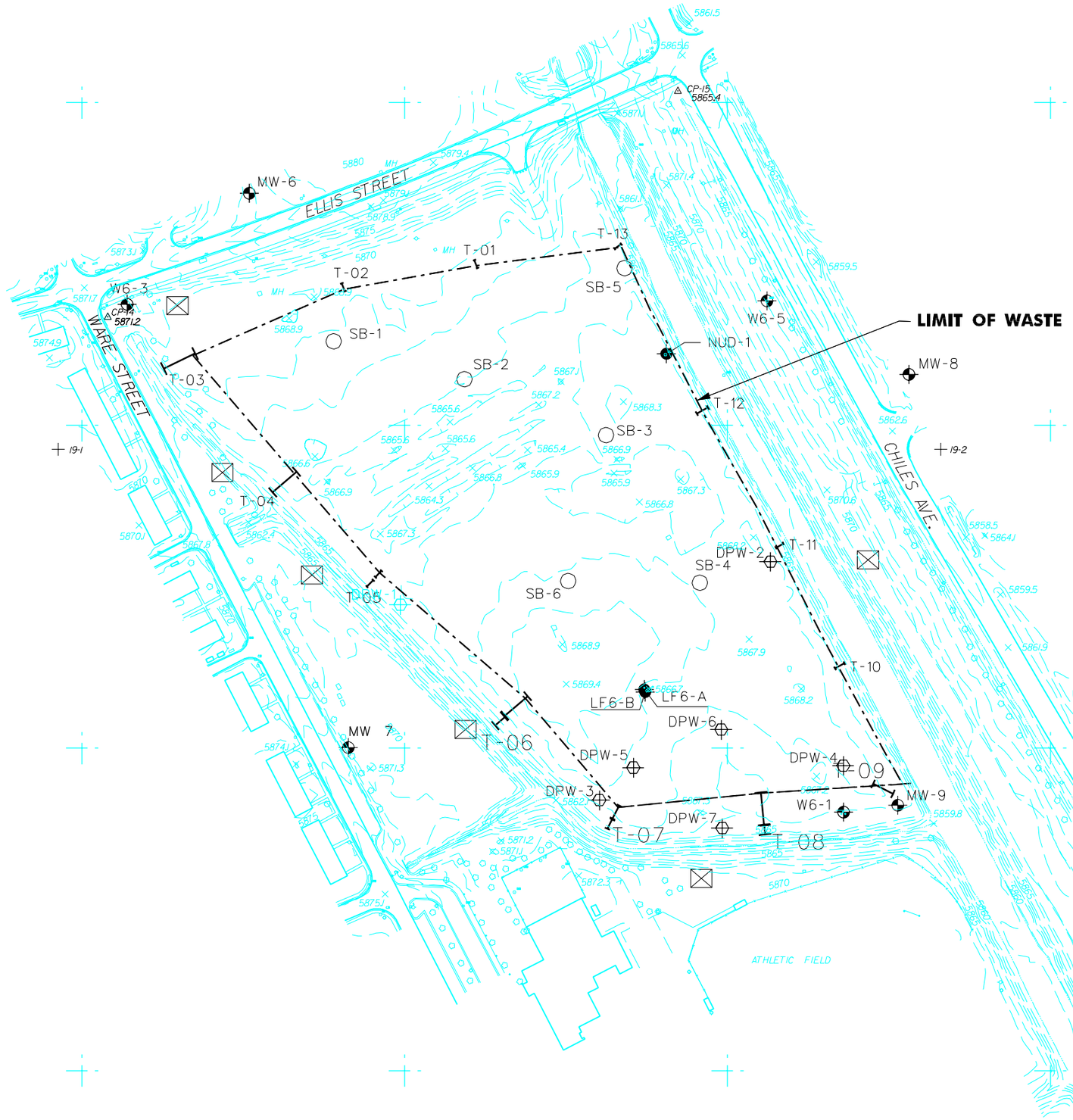
EARTH TECH

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MY
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

FIGURE 3
EXISTING CONDITIONS
LANDFILL No.5 (FTC-009)

Plot Scale Ratio:
Date: AUGUST 1997
Design File LF5EXCON.DGN
Spec. No.: DACW 45
Contract No.: DACW 45
Drawing Code:
Sheet Ref Number: C-5



LEGEND

NUD-1	LOCATION OF ABANDONED MONITORING WELL
MW-9	LOCATION OF EXISTING MONITORING WELLS TO BE SAMPLED
SB-1	BORING LOCATION
DPW-2	DIRECT PUSH WATER SAMPLE LOCATION
△	SURVEY CONTROL POINT
T-03	LOCATION OF TRENCH
⊠	APPROXIMATE LOCATION OF SOIL GAS PROBES TO BE INSTALLED PRIOR TO FINAL CAP INSTALLATION

NOTE:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853
ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3960'

N

SCALE: 1 INCH=150 FEET
75' 0 75'

$$ - THINK VALUE ENGINEERING - $$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE
MOUNTAIN DIVISION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MF
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

FORT CARSON COLORADO

FIGURE 4

EXISTING CONDITIONS

LANDFILL 6 (FTC-010)

Plot Scale Rati AS SHOWN
Design File: LF6EXCON.DGN
Date: JUNE 1997
Spec. No.: DACW 45
Contract No.: DACW 45
Drawing Code:
Sheet reference number:

COMPUTER AIDED DESIGN & DRAFTING

APPENDIX A
DRAFT SITE-SPECIFIC SAFETY AND HEALTH PLAN

DRAFT
SITE-SPECIFIC
HEALTH AND SAFETY PLAN
LANDFILLS 2, 5, AND 6 CAP INSTALLATION PROJECT
FORT CARSON, COLORADO

Prepared for:
Amoco Oil Company
Golden, Colorado

Prepared by:
Rust Environment & Infrastructure
Englewood, Colorado

Project No. 89868.300

November 1995

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Section **Page**

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
dBA	Decibel (A-weighted)
IDLH	Immediately Dangerous to Life or Health
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Health
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
Rust	Rust Environment & Infrastructure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
USACE	U.S. Corps of Engineers
WBGT	Wet Bulb Globe Temperature Index

A1.0 INTRODUCTION

The following Site Specific Safety and Health Plan (SSHP) is intended as an addendum to the Programmatic Site Safety and Health Plan developed for project work completed at Fort Carson, Colorado. This SSHP contains information specific to the installation caps at Landfills 2, 5, and 6.

This SSHP has been prepared in conformance with U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual EM 385-1-1, Occupational Safety and Health Administration (OSHA) Title 29 Code of Federal Regulations (CFR) 1910.120 - Hazardous Waste Site Operations and Emergency Response, 29 CFR 1910.1200 - Hazard Communication, 29 CFR 1910.134 - Respiratory Protection, and 29 CFR 1926-Construction. Compliance with this SSHP is required of all Rust Environment & Infrastructure (Rust) Team personnel who are involved on the Landfills 2, 5 and 6 Cap Installation Project.

A2.0 SITE DESCRIPTION

A2.1 LANDFILL 2

The former Landfill 2 is located east of the Cantonment Area, SE 1/4, Sec 15, T15S, R66W. The Cantonment Area is bounded on the northeast by Interstate Highway 25, on the north by the Fort Carson Reservation boundary, and on the east by Colorado State Road 115. This site reportedly covered approximately 140 acres, and reportedly operated between 1960 and 1978 as a combined trench and fill landfill. The trenches were supposedly oriented perpendicular to the topographic slope. The types of waste reportedly received at this site include mixed loads of sanitary wastes, sludges, and waste petroleum, oil, and lubricants.

A2.2 LANDFILL 5

The former Landfill 5 is located in the northeast corner of the Cantonment Area, SW 1/4, Sec 10, T15S, R66W. The site reportedly covered over 26 acres, and was reportedly operated between 1946 and 1956. The method of landfill operation used is unknown, however, it is reported that the types of waste received at the site include construction debris, mixed sanitary waste, waste petroleum, oil, and lubricants, waste from an old horse barn, coal cinders and ash.

A2.3 LANDFILL 6

The former Landfill 6 is located in the west end of the Cantonment Area, E1/2, Sec 17, T15S, R66W. The site reportedly covered aproximately eight acres, and was reportedly operated between 1942 and 1946. The landfill is assumed to have operated as a trench type landfill, with refuse placed in trenches, compacted by several passes of a bulldozer, and covered with locally obatained soil fill. The trenches are oriented southwest to northeast. The types of waste reportedly received at the site included construction debris, mixed sanitary waste, sludges, and waste petroleum, oil, and lubricants.

A3.0 SCOPE OF WORK

The scope of work for the Landfills 2, 5 and 6 Cap Installation Project is described in the Work Plan and will progress through the following three phases.

- Mobilization/Site Preparation - The cap installation workforce will mobilize to Landfills 2, 5, and 6 to commence with the initial installation phase.
- Cap Installation - Before the cap is installed, specific monitoring wells will be abandoned and plugged and direct push groundwater samples will be collected. After the cap has been installed, new monitoring wells will be installed.
- Post-Construction - After cap installation is accomplished, the groundwater will be sampled as part of monitoring.

A3.1 LANDFILL 2 - ACTIVITIES

Cap construction activities for Landfill 2 include the characterization of existing cover soils, waste relocation, well plugging, well installation, and revegetation. Approximately 43 acres of the landfill appear to have sufficient cover over the waste to act as a cap. This area will be evaluated by drilling 29 shallow borings to determine the thickness of the cover layers. Areas found to have insufficient cover materials will be supplemented with fill from an onsite borrow area.

It is estimated that 67,500 cubic yards of material will be relocated from the north and north-east portions of the landfill. This material will be consolidated within the area proposed for the new cap. Cap installation will consist of the placement of 2 feet of low permeability soils, and 3 feet of general cover soils. The new cap will cover an area of approximately 33 acres.

Prior to placement of any cap components, four monitoring wells which exist within the perimeter of the new cap will be abandoned and plugged and seven direct push groundwater samples will be collected. At the completion of construction, 11 new monitoring wells will be installed. Pre-construction activities will include the excavation of 18 trenches to confirm the extent of landfill materials in the area proposed for the new cap.

A3.2 LANDFILL 5 - ACTIVITIES

Cap construction at Landfill 5 will begin with the excavation of eight trenches to confirm the extent of landfill materials. Monitoring wells which exist within the perimeter of the proposed caps will be abandoned and plugged. In addition, six direct push groundwater samples will be collected.

Approximately 107,700 cubic yards of surface debris from the eastern portions of the landfill will be consolidated within the area proposed for the capped areas. The asphalt cap will cover an 11 acre area and will include a flexible membrane liner overlain by asphalt. A soil cap as described for Landfill 2 will be installed over a 10 acre portion of the landfill. This area of the landfill will receive 100,000 cubic yards of surface debris from the eastern portions of the landfill. Following cap construction, seven new monitoring wells will be installed and the entire area will be revegetated.

A3.3 LANDFILL 6 - ACTIVITIES

Cap construction activities for Landfill 6 include the consolidation of wastes, trenching to delineate the landfill perimeter, and placement of cap materials. The cap will consist of a low permeability layer and a protective soil cover layer as described for Landfill 2. Prior to cap construction, 24,000 cubic yards of materials from the edge of the landfill will be relocated to a central portion of the landfill, and wells which exist within the cap perimeter will be plugged. When cap construction is complete, all affected areas will be revegetated.

A4.0 PROJECT PERSONNEL

The following is a list of the key project personnel, organizations, and telephone numbers.

Name	Title	Organization	Telephone Number
John Shaler	Program Manager	Rust	303/694-6660
Mark Scott, PE	Chief Project Manager	Rust	719/471-7070
John England, PE	Project Manager	Rust	303/694-6660
Wendy Johnson, CIH, CSP	Project Safety and Health Manager	Rust	303/694-6660
Mark Yaskanin, PE	Project Engineer	Rust	303/694-6660
Jim Henderson	Remedial Program Manager	Fort Carson	719/526-8001
Linda White, PE	Technical Manager	USACE	402/221-7672
To Be Determined	Construction Manager	OHM	303/371-8252
To Be Determined	Health and Safety Coordinator	OHM	303/371-8252
To Be Determined	Quality Assurance/ Quality Control	Rust	303/694-6660

A5.0 HAZARD OVERVIEW

The primary health and safety hazards to be encountered during Landfills 2, 5 and 6 cap installation task include:

- Chemical Hazards;
- Physical Hazards;
- Biological Hazards; and
- Ergonomic Hazards.

Several hazards may be encountered during the course of each task. Anticipated hazards are addressed in the following sections. Some of these hazards and their respective safety controls are detailed in the Programmatic SSHP.

A5.1 CHEMICAL HAZARDS

The types of waste reportedly received at Landfill 2 include mixed loads of sanitary wastes, sludges, and waste petroleum, oil, and lubricants. Landfill 5 received construction debris, mixed sanitary waste, petroleum, oil, and lubricants, waste from an old horse barn, coal cinders and ash. The types of waste expected at Landfill 6 include construction debris, mixed sanitary waste, sludges, and waste petroleum, oil, and lubricants.

Material Safety Data Sheets (MSDSs) for any chemicals used onsite will be obtained prior to or upon their delivery at Fort Carson. Each MSDS will be reviewed by the Site Safety and Health Officer (SSHO) and modifications to SSHP procedures will be made. The information provided by the MSDS will be reviewed with those affected employees, prior to the chemicals use, during periodic safety briefings.

A5.2 PHYSICAL HAZARDS

Physical hazards associated with construction activities associated with this project are typical of construction projects. These hazards include:

- Slips, trips, and falls from uneven work surfaces in the work area;

- Step and fall accidents occur when the foot encounters an unexpected step down. This can also happen when an employee thinks he or she has reached the bottom of the stairs when, in reality, there is one more step.

- Slip and fall accidents occur when the worker's center of gravity is suddenly thrown out of balance.

Rust plans to use the following strategies to help prevent slip, trip, and fall hazards:

- Practice good housekeeping. All working areas will be kept as clean and dry as possible.

- Require nonskid footwear. All employees will be required to wear footwear with nonskid soles.

- Inspect surfaces on, at a minimum, a daily basis. One person on each crew will be required to conduct daily inspections of the work area and act immediately when a hazard is identified. In addition, all personnel will immediately notify their supervisor or the SSHO whenever a slip, trip, or fall hazard occurs.

A5.2.3 Ladder Safety

Some operations during site activities, including entry into excavations, may require the use of ladders. Rust requires that ladders be inspected before every use. The following checklist will be used when inspecting a ladder:

- Determination of ladder strength;
- Identification of existing labels concerning weight capacity and applications;
- Inspection for the following conditions: cracks on side rails, loose rungs, rails, or braces;
- Inspection for heat damage or corrosion;
- Inspection of wooden ladders for moisture that might cause them to conduct electricity;
- Inspection of metal ladders for burrs and sharp edges; and
- Inspection of fiberglass ladder for signs of deterioration of exposed fiberglass.

The National Safety Council also recommends the following do's and don'ts of ladder use.

- Do check for slipperiness on shoes and ladder rungs;
- Do limit a ladder to one person at a time;
- Do secure the ladder firmly at the top and bottom;
- Do set the ladder's base on a firm, level surface;
- Do apply the four-to-one ratio (base 1 foot away from the wall for every 4 feet between the base and the support point);
- Do face the ladder when climbing up and down;
- Do barricade the base of the ladder when working near an entrance;
- Don't lean a ladder against a fragile, slippery, or unstable surface; and
- Don't lean too far to either side while working (stop and move the ladder).

All ladders are to be certified as safe prior to use. Fall protective devices for any activity over 6 feet above ground level will be used as required by the USACE Safety and Health Requirements Manual EM 385-1-1 and OSHA.

A5.2.4 Control of Hazardous Energy (Lockout/Tagout)

During the course of Landfills 2, 5 and 6 Cap Installation Project, employees may be exposed to hazardous energy sources including energized electrical lines. Release of this electrical energy could lead to serious physical harm to employees. Thus, prior to working around these sources, the systems will be isolated in accordance with the procedures presented below and in full compliance with EM 385-1-1 and OSHA 29 CFR 1910.147.

For all activities involving hazardous energy sources, the following general procedures will be followed, along with the procedures detailing the Hazardous Energy Control Plan furnished by the contractor performing the work. The SSHO will ensure contractor has a hazardous energy control plan which is in compliance with EM 385-1-1.

- The SSHO or designee will coordinate, approve, and be present for all activities requiring lockout/tagout.
- The SSHO, Construction Manager, and contractor will conduct an inspection of the worksite to ensure all hazardous energy sources are identified and their main source switch located.
- The SSHO or designee will notify those employees involved in the activity and those individuals who may potentially enter the location of the main energy isolating device and/or the location where activities will take place.
- The SSHO or designee will place a suitable locking device on the main energy isolation device to isolate the energy after a qualified, knowledgeable person (i.e., person with thorough knowledge of the system being controlled including its operation, its associated hazards, and its control) turns off the energy source. If there is no way to place a locking device on the isolating device, a tag will be placed with employees given clear instruction as to its purpose.
- A suitable locking device is one which is capable of withstanding the environment in which it is being used, for the duration of its use. In addition, the locking device will have a means of indicating who applied it. It will be substantial enough and operate in a way as to eliminate the possibility of unauthorized, or in advertent removal without the use of excessive force or unusual techniques (i.e., bolt cutters).

- All employees involved in the activity will be briefed on the lockout/tagout requirements as a review of the discussion provided in the site-specific training.

- Following placement of the locking device or tag, the system will be tested by a qualified individual to ensure that the system has been de-energized.

- If the activity is stopped prior to its completion for breaks, lunch, end of day, etc., the SSHO will inspect the site and the lockout/tagout devices prior to leaving the site. In addition, prior to proceeding with the activity after the work stoppage, the SSHO will once again inspect the site and the lockout/tagout devices to ensure all is safe to resume. These inspections will be documented by the SSHO.

- Prior to removing lockout/tagout devices, the SSHO will inspect the area to ensure all items are in order, all employees notified, and safety positioned, and all system components operationally intact.

- Only the SSHO who placed the locking device will be authorized to remove it. The SSHO will remove the device, and energy restored to the system.

A5.2.5 Electrical Shock Prevention

Various pumps and other machinery are operated by electrical current. All electrical equipment will be properly grounded. The use of ground-fault circuit interrupters or equivalent for hand tools is necessary to eliminate the potential for electric shock. All equipment must be approved for the class of hazard as listed in OSHA standards for electrical power (29 CFR 1926, Subpart K).

A5.2.6 Electrical Safety

Extension cords shall be the three-wire type for grounded tools (two-wire is permissible for double-insulated tools) and shall be protected from damage. Electrical cords shall not be fastened with staples or extended across aisles or walkways. Worn or frayed cords shall not be used and will be cut to prevent inadvertent use. Cords shall not be run through doorways where the door could cut or damage them.

Exposed bulbs on temporary lights shall be guarded to prevent accidental contact, except where bulbs are deeply recessed in the reflector. Temporary lights shall not be suspended by their electric cords unless specifically designed for this use. Explosion-proof bulb covers shall be used when contact with flammable vapors or gases is possible and shall met Class I, Division I, requirements.

All ladders are to be certified as safe prior to use. Fall protective devices for any activity over 6 feet above ground level will be used as required by the USACE Safety and Health Requirements Manual EM 385-1-1 and OSHA.

A5.2.4 Control of Hazardous Energy (Lockout/Tagout)

During the course of Landfills 2, 5, and 6 Cap Installation Project, employees may be exposed to hazardous energy sources including energized electrical lines. Release of this electrical energy could lead to serious physical harm to employees. Thus, prior to working around these sources, the systems will be isolated in accordance with the procedures presented below and in full compliance with EM 385-1-1 and OSHA 29 CFR 1910.147.

For all activities involving hazardous energy sources, the following general procedures will be followed, along with the procedures detailing the Hazardous Energy Control Plan furnished by the contractor performing the work. The SSHO will ensure contractor has a hazardous energy control plan which is in compliance with EM 385-1-1.

- The SSHO or designee will coordinate, approve, and be present for all activities requiring lockout/tagout.
- The SSHO, Construction Manager, and contractor will conduct an inspection of the worksite to ensure all hazardous energy sources are identified and their main source switch located.
- The SSHO or designee will notify those employees involved in the activity and those individuals who may potentially enter the location of the main energy isolating device and/or the location where activities will take place.
- The SSHO or designee will place a suitable locking device on the main energy isolation device to isolate the energy after a qualified, knowledgeable person (i.e., person with thorough knowledge of the system being controlled including its operation, its associated hazards, and its control) turns off the energy source. If there is no way to place a locking device on the isolating device, a tag will be placed with employees given clear instruction as to its purpose.
- A suitable locking device is one which is capable of withstanding the environment in which it is being used, for the duration of its use. In addition, the locking device will have a means of indicating who applied it. It will be substantial enough and operate in a way as to eliminate the possibility of unauthorized, or in advertent removal without the use of excessive force or unusual techniques (i.e., bolt cutters).

Receptacles for attachment plugs shall be of the approved, concealed, contact type. Where different voltages, frequencies, or types of current are supplied, receptacles shall be of such design that attachment plugs are not interchangeable.

Electrical tools and appliances used in wet environments shall require ground fault interrupters and water-tight connectors.

A5.2.7 Crush Potential

A crushing hazard exists when a part of the body may be caught between two hard surfaces which progressively move together. Generally there are three categories for crushing hazards: squeeze points; run-in points; and impact hazards.

Squeeze-point hazards exist where two hard surfaces, at least one of which must be in motion, push close enough together to crush an object that may be located between them.

Run-in point hazards exist where two objects, at least one of which is rotating, move progressively close together. The gap between the objects need not become completely close but only be smaller than the body part lodged in it.

Impact hazards are accidents that involve acceleration and impact. Examples of impact hazards are a heavy object falling on a foot or a hammer hitting a finger.

The following general safeguards will be used to prevent injuries from crushing actions:

- All self-propelled construction and industrial equipment will be equipped with operating back-up alarms;
- All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, and other moving parts will be guarded where those parts may be contacted by persons or create a hazard;
- Guards shall be left in place except when their removal is necessary for maintenance and only after the equipment has been appropriately locked-out or otherwise protected from starting;

- Appropriate personal protective equipment will be worn (i.e., hardhats, steel toed shoes/boots) as necessary to protect against crushing hazards;
- Only personnel trained in the operation of the necessary equipment will operate it;
- All overhead items will be properly secured;
- Mechanized equipment will be utilized where possible or assistance from one or more persons will be utilized when lifting or moving objects that could pose a crush hazard; and
- Personnel shall keep hands and other body parts away from moving objects and always be on guard for moving objects and vehicles.

The following guidelines will be used when establishing safeguards during site activities to ensure that the safeguard:

- Prevents contact with the hazard;
- Is secure and durable;
- Protects against falling objects;
- Creates no new hazard;
- Does not interfere with work that needs to be performed; and
- Allows for safe maintenance.

A5.2.8 Noise Hazards

Noise is a potential hazard associated with the operation of heavy equipment, pumps, generators, jackhammers, and power tools. Engineering and administrative controls will be implemented at 80 decibels (A-weighted) (dBA) when possible to reduce noise levels in the work zones. Noise hazard areas will be marked with caution signs indicating the presence of hazardous noise levels and the requirements for hearing protection.

A5.2.9 Underground/Overhead Utilities

Rust will coordinate with Fort Carson to identify the locations of all underground utilities prior to any excavation. Damage to underground utilities during site activities could lead to electric shock, explosion, and serious injury. Before beginning work, the SSHO will verify and inspect work procedures and equipment and the location of overhead lines to ensure that no portion of an individual or equipment is brought within the safe minimum clearance detailed in Table 5-1 of the Programmatic SSHP. Whenever possible, all circuits adjacent to the planned activity shall be de-

energized by Fort Carson. Fort Carson will then provide the SSHO with written verification of the de-energization and circuit lock-out. At no point should work begin without this verification. If de-energizing of the circuit is not possible or practical, the minimum safe clearance detailed in Table 5-1 of the Programmatic SSHP will be maintained for all operations. If de-energizing is possible, work will not start until power has been disabled and an effort has been made to de-energize the lines and Fort Carson verification has been received.

A5.2.10 Heat Stress

Heat stress may be a hazard if the landfill cap installation work is performed during summer months. Heat stress is caused by external heat sources such as high ambient air temperature and direct sunlight, or internal body heat build-up resulting from heavy work or prolonged use of protective gear. Heat stress may manifest itself as heat cramps, heat exhaustion, and heat stroke. See the Programmatic SSHP for a further discussion of heat stress.

The SSHO will establish a work/rest schedule, as recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), on a daily basis depending on weather conditions and site activities. Rest should be sought in the shade. Table A-2a will be used as a guide for establishing a work/rest regimen when workers are required to wear a basic work uniform. Wet Bulb Globe Temperature Index (WBGT) values will be corrected when workers are in any level of protection by subtracting 6 from each value. While it is anticipated that respiratory protection will be the only additional personal protection device required over and above the standard construction wear, Table A-2b will be used as a guide for establishing a work/rest regimen when workers are required to wear any level of protection (including a respirator).

A5.2.11 Cold Stress

Cold stress conditions may exist if landfill cap installation is performed during the winter months. Cold stress, including frostbite and hypothermia, can result in severe health effects. Bare flesh and areas with high surface area to body volume ratios are highly susceptible to wind chill or low temperatures. The Programmatic SSHP has a detailed discussion of cold stress.

Monitoring for cold stress is difficult and will be accomplished by the SSHO by monitoring for symptoms of frostbite and hypothermia and monitoring the weather conditions on a daily basis. In addition, project team personnel will be equipped with adequate cold protective clothing. The SSHO will also establish regimes for adequate warming as recommended by the ACGIH. Table A-3 will be used as a guideline for establishing a work/rest regimen.

A5.2.12 Illumination Requirements

A portion of the landfill cap installation work may be conducted during low light level periods in the mornings and evenings. Each area must have adequate lighting for personnel to safely perform work activities and identify potential hazards. While work activities are in progress, access ways and site work areas will be lighted to at least the minimum light intensities specified in Minimum Lighting requirements of EM 385.1-1 (Table A-4).

A5.2.13 Vibration

Project employees may operate different types of vibrating equipment during construction activities. Prolonged use of vibrating equipment has the potential to produce a condition known as vibration syndrome. Vibration syndrome has adverse circulatory and neural effects on the fingers. Signs and symptoms include numbness, pain, and blanching of the fingers which are of particular concern since they are evidence of advanced stages of vibration syndrome after exposures as short as one year. In general, National Institute of Occupational Health (NIOSH) recommendations will be followed to prevent the occurrence of vibration syndrome:

- Where tasks cannot be redesigned to eliminate vibrating tools such as pneumatic hammers, concrete saws and grinder, a combination of engineering controls, work practices, and administrative controls will be employed to minimize exposure to vibrating equipment.
- Employees using vibrating tools will be informed of the symptoms of vibration syndrome.
- Vibrating tools and equipment will be maintained according to manufacturer's recommendations.
- Work schedules with a 10-minute break after each hour of continuous exposure will be utilized.
- Employees using vibrating tools will be advised to:

- Wear adequate clothing to keep the body temperature stable and normal, since low body temperature reduces blood flow to the extremities and therefore may trigger an attack of vibration syndrome. In addition, employees will be advised to keep their hands warm and dry on the job.

- Let the tool do the work, grasping it as lightly as possible while working safety and maintaining tool control. The tool should rest on the workpiece or support as much as possible. The tighter the tool is held, the greater the vibration transmitted to the employee.

A5.2.14 Hand and Power Tools

Hand and power tools will be utilized on the Landfills 2, 5, and 6 Cap Installation Project. The following is a list of safety tips and recommendations for the safe use of hand and power tools.

- Power tools shall be of a manufacturer listed by a nationally recognized testing laboratory for the specific application for which they are to be used.

- Hand and power tools shall be used, inspected, and maintained in accordance with the manufacturer's instructions and recommendations and shall be used only for the purpose for which designed. A copy of the manufacturer's instructions and recommendations shall be maintained with the tools.

- Hand and power tools shall be inspected, tested, and determined to be in safe operating condition prior to use. Continued periodic inspections shall be made to assure safe operating condition and proper maintenance.

- Hand and power tools shall be in good repair and with all required safety devices installed and properly adjusted. Tools having defects that will impair their strength or render them unsafe shall be removed from service.

- Power tools designed to accommodate guards shall be equipped with such guards when in use.

- When work is being performed overhead, tools not in use shall be secured or placed in holders.

- Throwing tools or materials from one location to another or from one person to another, or dropping them to lower levels, shall not be permitted.

- Only nonsparking tools shall be used in locations where sources of ignition may cause a fire or explosion.

A5.2.15 Heavy Equipment Safety

Heavy equipment can represent a substantial hazard to workers. In general, the requirements for motor vehicles and material handling equipment provided in the OSHA Construction Industry Standard 29 CFR 1926, Subpart O and applicable sections of EM 385-1-1 will be adhered to:

- Use common sense. Workers will not assume that the equipment operator is keeping track of their whereabouts. Never walk directly in back of or to the side of, heavy equipment without the operator's knowledge.
- Hard hats, steel toe boots, and safety glasses are to be worn at all times around heavy equipment. Other protective gear as specified in this health and safety plan is also applicable.
- Remain alert at all times.
- Maintain visual contact at all times.
- Establish hand signal communication when verbal communication is difficult. Identify one person per work group to give hand signals to equipment operators.
- Be aware of footing at all times.
- Only qualified/licensed people are to operate heavy equipment.
- Use chains, hoists, straps, and any other equipment to safely aid in moving heavy materials.
- Use proper personal lifting techniques.
- Equipment will not be used by individuals who are not familiar with its operation. This applies to heavy and light equipment (e.g., chain saws).
- Be sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines will present a hazard in the work area.
- Keep all non-essential people out of the work area.
- Prohibit loose-fitting clothing or loose long hair around moving machinery.
- Keep vehicle cabs free of all non-essential items and secure all loose items.
- Instruct equipment operators to report to their supervisor(s) any abnormalities such as equipment failure, oozing liquids, unusual odors, etc.
- When an equipment operator must negotiate in tight quarters, provide a second person to ensure adequate clearance.

- Implement an ongoing maintenance program for all tools and equipment. Inspect all tools and moving equipment regularly to ensure that parts are secured and intact with no evidence of cracks or areas of weakness, that the equipment turns smoothly with no evidence of wobble, and that it is operating according to manufacturer's specifications. Promptly repair or replace any defective items. Keep maintenance and repair logs.

- Store tools in clean, secure areas so that they will not be damaged, lost or stolen.

- Keep all heavy equipment that is used in the exclusion zone in that zone until the job is done. Completely clean such equipment within the designated vehicle decontamination area.

- Parking brakes will be engaged when equipment is not in use.

- All vehicles with rollover protective structures (ROPS) will have seat belts; operators will be trained in the use of seat belts, and the seat belts will be used at all times during vehicle operation.

- With certain exceptions provided in 29 CFR 1926, Subpart O, all material handling equipment will be provided with ROPS.

- Equipment with an obstructed rear view must have an audible alarm that sounds when it is operating in the reverse direction (unless a spotter guides the vehicle operator).

- Material handling equipment that lacks ROPS must not be operated on a grade, unless the grade can safely accommodate the equipment involved.

- A safety barrier will be used to protect workers whenever a tire is inflated, removed, or installed on split rims.

- Heavy equipment will be inspected by the operator prior to the beginning of each work shift, and the SSHO will ensure the compliance to this regulation.

- All implements shall be completely lowered when equipment is not in use.

- Buckets or other implements shall not be used to lift or transport personnel.

- Unauthorized personnel shall be prohibited from riding on heavy equipment or forklifts unless provided with a safe place to ride.

- Employees shall not position themselves between a fixed object and heavy equipment.

- Operators will ascend and descend heavy equipment facing the machine and maintaining three points of contact at all times.

- Operators will not jump from heavy equipment.

A5.2.16 Trenching and Excavations Protocols

Trenching and excavation activities will be conducted during the Landfills 2, 5, and 6 Cap Installation Project and will be in accordance with USACE EM 385-1-1 Section 25, and OSHA 29 CFR 1926 Subpart B. Listed below are the trenching and excavation protocols that will be used during Landfills 2, 5, and 6 cap installation.

A5.2.16.1 Planning

Prior to opening an excavation, underground installations (e.g., sewer, telephone, water, fuel, electric lines) will be located and protected from damage or displacement. Fort Carson shall be responsible for locating and marking the locations.

A5.2.16.2 Excavation Inspection and Testing

A competent person designated by SSHO will inspect all excavations, the adjacent areas, and protective systems on a daily basis, as needed throughout work shifts, and after every rainstorm or other hazard-increasing occurrence. If evidence of a situation which could result in possible cave-ins, slides, failure of protective systems, hazardous atmospheres, or other hazardous condition is identified, exposed workers shall be removed from the hazard and all work in the excavation shall stop until all necessary safety precautions have been implemented.

In locations where oxygen deficiency or gaseous conditions are known or suspected, air in the excavation shall be tested prior to the start or more often, if directed by the designated authority. A log of all test results shall be maintained at the work site.

A5.2.16.3 Protective Systems

The following protective systems will be instituted:

- The sides of all excavations in which employees are exposed to danger from moving ground shall be guarded by a support system, sloping or benching of the ground, or other equivalent means.
- Excavations less than 5 feet in depth examined by a competent person and determined to have no potential for cave-in, do not require protective systems.

- Sloping or benching of the ground shall be in accordance with Section 25.C of EM 385-1-1.
- Support systems shall be in accordance with Section 25.D of EM 385-1-1.
- Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied to the system.

A5.5.16.4 Stability of Adjacent Structures

Except in stable rock, excavations below the level of the base of footing of any foundation or retaining wall shall not be permitted unless:

- A support system, such as underpinning, is provided to ensure the stability of the structure and to protect employees involved in the excavation work or in the vicinity thereof; or
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation and that the excavation will not pose a hazard to employees.

If the stability of adjoining buildings or walls is endangered by excavation, shoring, or bracing, underpinning designed by a qualified person shall be provided to ensure the stability of the structure and to protect employees.

Sidewalks, pavements, and related structures shall not be undermined unless a support system is provided to protect employees and the sidewalk, pavement, or related structure.

A5.2.16.5 Excavation Undercut

Where it is necessary to undercut the side of an excavation, overhanging material shall be safely supported.

A5.2.16.6 Protection from Water

Diversion ditches, dikes, or other means shall be used to prevent surface water entering an excavation and to provide good drainage of the area adjacent to the excavation.

Employees shall not work in excavations in which there is accumulated water or in which water is accumulating unless the water hazards posed by accumulation are controlled.

Freezing, pumping, drainage, and similar control measures shall be planned and directed by a competent engineer. Consideration shall be given to the existing moisture balances in surrounding soils and the affects on foundations and structures if it is disturbed.

When continuous operation of groundwater control equipment is necessary, an emergency power source shall be provided. Water control equipment and operations shall be monitored by a competent person to ensure proper operation.

A5.2.16.7 Protection from Falling Material

Employees shall be protected (by scaling, ice removal, benching, barricading, rock bolting, wire mesh, or other means) from loose rock or soil which could create a hazard by falling from the excavation wall. Special attention shall be given to slopes which may be adversely affected by weather, moisture content, or vibration.

Materials, such as boulders or stumps, that may slide or roll into the excavation shall be removed or made safe.

Excavated material shall be placed at least 2 feet from the edge of an excavation or shall be retained by devices which are sufficient to prevent the materials from falling into the excavation. In any case, material shall be placed at a distance to prevent excessive loading on the face of the excavation.

A5.2.16.8 Mobile Equipment and Motor Vehicle Precautions

When vehicles or mobile equipment is used or allowed adjacent to an excavation, substantial stop logs or barricades shall be installed. The use of a ground guide is recommended.

Workers shall stand away from vehicles being loaded or unloaded to avoid being struck by spillage or falling materials.

Excavating or hoisting equipment shall not be allowed to raise, lower, or swing loads over personnel in the excavation without substantial overhead protection.

A5.2.16.9 Work on Faces or Sloped Excavations

Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at lower levels are adequately protected from the hazard of falling material or equipment.

A5.2.16.10 Underground Utilities

When operations approach the location of underground utilities, excavation shall progress with caution until the exact location of the utility is determined. Workers shall be protected from the utility, and the utility shall be protected from damage or displacement.

A5.3 BIOLOGICAL HAZARDS

Biological hazards that may be present in Landfills 2, 5, and 6 include spiders, bees, wasps, prairie dogs, and snakes. Considerations for biological hazards may be necessary when workers are required to enter remote or seldom-visited locations. Biological hazards are detailed in Section 5.3 of the Programmatic SSHP.

Spiders, bees, and wasps can be considerable hazard for those people with known allergic reactions to the venom. The SSHO should be notified if any worker is sensitive to these biological hazards.

Bloodborne pathogens may also be a concern at Fort Carson. There is potential for worker injury during site-specific tasks, resulting in possible worker exposure to bloodborne pathogens (i.e., hepatitis B virus and human immunodeficiency virus). To avoid occupational exposure, workers will be trained according to 29 CFR 1910.1030 (Occupational Exposure to Bloodborne Pathogens). More detail on Bloodborne Pathogen Exposure control is provided in the Programmatic SSHP.

A5.4 ERGONOMIC HAZARDS

Ergonomics is the science of fitting people and their work tasks comfortably together. Employees should be aware of ergonomic controls that reduce on-the-job stress and strain. The following issues will be addressed to assess the ergonomic hazards during site activities:

- Are tasks being performed that involve unnatural or hazardous movements?
- Are tasks being performed that involve frequent manual lifting?

- Are tasks being performed that involve excessive wasted motion?
- Are tasks being performed that involve unnatural or uncomfortable postures?
- Are tasks being performed that should be automated?

Each task will be evaluated based on these questions, and controls will be implemented as is practical and feasible.

A6.0 EXPOSURE MONITORING

The monitoring of the environment at Landfills 2, 5, and 6 will be necessary to ensure that proposed levels of protection and procedures are adequate to ensure the health and safety of personnel onsite. Monitoring of the environment will include ambient air monitoring and heat/cold stress monitoring. The information gained will be used to adjust levels of protection and work/rest regimens.

A6.1 EQUIPMENT AND INSTRUMENTATION

The procedures for the operation and maintenance of real time direct reading air monitoring instruments and personal sampling equipment for industrial hygiene parameters will be available onsite.

A6.2 MONITORING STRATEGY

Air monitoring shall be conducted to identify any immediately dangerous to life or health (IDLH) conditions and exposures over published exposure levels. See Table A-5 for monitoring requirements.

A6.3 REAL-TIME MONITORING

Real-time monitoring will be conducted during all activities within excavated areas. See Table A-6 for real-time monitoring action levels. Additional monitoring will be required at the discretion of the SSHO.

A6.4 INITIAL CHARACTERIZATION MONITORING

The SSHO will conduct initial monitoring to characterize the exposures for each work activity. Initial characterization monitoring will be conducted on those workers who represent the highest exposure potential for that job classification. The number of workers included in the air monitoring program will be expanded from only high-risk workers when exposures are suspected of exceeding action limits.

A6.5 NOISE MONITORING

The SSHO will perform a general sound level survey of all tasks. Noise dosimetry will be conducted on those workers who represent the highest exposure potential.

A6.6 CALIBRATION/MAINTENANCE

All instruments (both real-time and personal sampling equipment) will be calibrated according to the manufacturer's recommendations. All equipment will be calibrated before and after use. A calibration log will be kept to record all calibrations. Real-time instrument results will be recorded in the daily safety log books used by each health and safety officer.

A6.7 METHODS

Integrated samples will be collected, at the discretion of the SSHO, using NIOSH methods or OSHA methods. Sampling flow rates will be in accordance with method requirements in order to assess adequacy of personal protective equipment (PPE) and potential exposure of contaminants to employees. Samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory.

A6.8 EXPOSURE RECORDS

The SSHO will forward all personnel exposure records to the Rust Division Health and Safety Officer. Report of exposure will be provided, upon written request, to the individual within 15 days upon receipt of the results.

A7.0 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

PPE will be used to reduce or eliminate chemical and physical hazards that may be encountered during field activities. Personnel shall wear protective equipment when field operations involve known or suspected hazards associated with activities at Landfills 2, 5, and 6. Based on the hazards associated with specific activities, and air monitoring results, the SSHO will make the final determination. Where appropriate, PPE worn shall meet American National Standards Institute (ANSI) requirements. The level of protection for each activity associated with Landfills 2, 5, and 6 tasks are included in Section A8.0.

The general ensemble components required to provide Level D, Level C, and Level B protection are listed in Tables A-7 through A-9. Most activities are anticipated to require Level D protection. Level C and Level B are not anticipated to be necessary.

A8.0 ACTIVITY HAZARD ANALYSIS

The hazards of each major phase of Landfills 2, 5, and 6 installation work are identified below. Detailed descriptions of the activities associated with each phase are presented in Section A3.0. Procedures to control the hazards associated with each phase are detailed in Sections A5.0 through A7.0 of this SSHP. These analyses are general in nature and do not serve as a substitute for formal hazard analyses which will be performed by the contractors prior to initiating each task. The forms, presented in Figure 7-1 of the Programmatic SSHP, will be completed by the contractor and reviewed with affected personnel as part of required safety briefings.

Only chemical and physical hazards are presented here as ergonomic and biological hazards as described in Section A5.0 are the same for all phases. Where two levels of protection are provided, the lower of the two will be the initial level of protection as the higher level is listed only as a possible requirement. However, it is not anticipated or expected that the higher level would be required except in the event of an extreme situation. Monitoring will be conducted to ensure the appropriate level of protection is being worn by site personnel during each task.

A8.1 MOBILIZATION AND SITE PREPARATION

- Chemical Hazards: None anticipated;
- Physical Hazards: Heavy equipment, noise, temperature stress; and
- Level of Protection: Level D.

A8.2 LANDFILL CAP INSTALLATION PHASE

- Chemical Hazards: Waste petroleum, oil, and lubricants;
- Physical Hazards: Heavy equipment; slip, trip, falls; vibration; crushing; power tools, electrical, noise, temperature stress; and
- Level of Protection: Level D.

A8.3 WELL REMOVAL/INSTALLATION PHASE

- Chemical Hazards: Cntaminated groundwater (waste petroleum, oil, and lubricants);
- Physical Hazards: Slip, trip, falls; vibration, hot water cleaners, power tools, electrical, noise, temperature stress; and
- Level of Protection: Level D.

A8.4 SAMPLING PHASE

- Chemical Hazards: Waste petroleum, oil, and lubricants;
- Physical Hazards: Heavy equipment, slips, trips, falls, power tools, noise, temperature stresses; and
- Level of Protection: Level D .

A9.0 SITE CONTROL AND DECONTAMINATION

A9.1 SITE CONTROL

Site control will be accomplished with existing construction site control measures. Work zones will be established around activities which create hazards but will be immediately removed when the hazard ceases. No contaminated materials are expected to be encountered.

A9.2 DECONTAMINATION

All equipment will be high pressure hot water washed until visibly clean, and major pieces of equipment will be wipe sampled to confirm the effectiveness of the pressure washing. If a surface is not accessible, then it will be deemed contaminated. Emergency equipment will remain in service (i.e., safety shower and eyewash) in the event emergency decontamination is required.

A10.0 EMERGENCY RESPONSE PLAN

See Programmatic SSHP for details of the Emergency Response Plan.

HOSPITAL:	Penrose Hospital 2215 N. Cascade Avenue Colorado Springs, CO 80907 719/630-5000
Directions to Offsite Medical Facility:	From Fort Carson take Highway 115 (South Nevada Avenue). Proceed North 6.5 miles to Jackson Street. Proceed West on Jackson one block to Emergency Room Entrance.
FIRE/RESCUE:	9-911
AMBULANCE:	9-911
Fort Carson Security:	719/526-2333; If on post, dial 2123
Fort Carson Health and Safety Office:	Building 1818 719/526-7000
Fort Carson Environmental Coordinator:	John Cloonan 719/526-8001
National Response Center:	1-800-424-8802

TABLES

TABLE A-1
TOXICOLOGICAL AND PHYSICAL PROPERTIES OF COMPOUNDS OF POSSIBLE CONCERN

Compound	Containing Material	CAS	Hazard[b]	Volatility[c]	Skin Abs[d]	Carcinogen[e]	Exposure Limit	Comments
methane	landfill	74-82-8	3	Yes	No	No	N/A	Flammable gas. Usually present in landfill as a result of decomposition of organic material. Also considered a simple asphyxiant.
petroleum hydrocarbons	landfill	varies	varies	Yes	Yes	No	varies	Compounds derived from petroleum products. Generally, amber to brown and may be irritating to the eyes and respiratory system. Can cause dermatitis. May cause intoxication upon inhalation.

Notes:

[a] CAS # - Chemical Abstracts System number.

[b] Hazard Rating - Based on SAX Hazard Ratings
1 = Indicates an LC50 of 500 - 5000 ppm; or the material is combustible or has some reactivity hazard.
2 = Indicates an LC50 of 100 - 500 ppm; or the material is flammable or reactive.
3 = Indicates an LC50 of below 100 ppm; or the material is explosive, highly flammable, or highly reactive.

Notes (continued):

[c] Volatility Rating - based on vapor pressures at 20°C.
VOL = compound with vapor pressure greater than 5 mm Hg

[d] Skin Absorption - "Yes" indicates that the compound has significant skin penetration based on ACGIH 1993-194 TLVs.

[e] Carcinogen - "Yes" indicates that the compound is a confirmed or suspected human carcinogen by the IARC, NIOSH, NTP, EPA, or ACGIH.

TABLE A-2a
PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES
(WORK UNIFORM)
(VALUES GIVEN IN °F WBGT)

	Work Load		
Work/Rest Regimen	Light	Moderate	Heavy
Continuous Work	86	80	77
75% Work - 25% Rest, each hour	87	82	78
50% Work - 50% Rest, each hour	89	85	82
25% Work - 75% Rest, each hour	90	88	86

TABLE A-2b
PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES
(ANY LEVEL OF PROTECTION)
(VALUES GIVEN IN °F WBGT)

	Work Load		
Work/Rest Regimen	Light	Moderate	Heavy
Continuous Work	80	74	71
75% Work - 25% Rest, each hour	81	76	72
50% Work - 50% Rest, each hour	83	79	76
25% Work - 75% Rest, each hour	84	82	80

TABLE A-3
THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT

Air Temperature-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Break
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Normal	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

TABLE A-4
MINIMUM LIGHTING REQUIREMENTS

Facility Name or Function	Intensity (footcandles)
Accessways	
- general indoor	5
- general outdoor	3
- exitways, walkways, ladders, stairs	10
Administrative areas (offices, drafting, meeting rooms, etc.)	50
Chemical laboratories	50
Construction areas	
- general indoor	5
- general outdoor	3
- tunnels and general underground work areas (minimum of 10 foot candles required at tunnel and shaft heading during drilling, mucking, and scaling)	5
Conveyor Routes	
	10
Docks and loading platforms	3
Elevators, freight and passenger	20
First aid stations and infirmaries	30
Maintenance, operating and construction areas	
- vehicle maintenance shop	30
- carpentry shop	10
- outdoors field maintenance area	5
- refueling area, outdoor	5
- shops, fine detail work	50
- shops, medium detail work	30
- welding shop	30
Mechanical/electrical equipment rooms	10
Parking areas	3
Toilets, wash and dressing rooms	10
Visitor areas	20
Warehouses and storage rooms and areas	
- stockrooms, active or bulk storage, indoors	10
- inactive storage, indoors	5
- rack storage, indoors	25
- outdoor storage	3
Work areas - general (not listed above)	30

TABLE A-5
MONITORING REQUIREMENTS

Type of Monitoring	Method of Monitoring	Location of Monitoring	Duration of Monitoring
Volatile Organic Compounds	Photoionization Detector and/or flame ionization detector	Breathing zone of workers subject to the highest levels	Continuous during operations in trenches or excavations
Lower Explosive Limit	Explosimeter	In trenches	Continuous
Oxygen	Oxygen meter	In trenches	Continuous
Respirable Dust	1) Real-time dust monitor	Breathing zone of workers subject to the highest levels	1) Continuous with dust monitor
Noise	Noise Dosimeter and/or Sound Level Meter	Area and/or lapel of worker subject to the highest levels	Periodic with sound level meter Daily with dosimeter
Heat Stress	Wet Bulb Globe Thermometer (WBGT)	Area	Continuous
Cold Stress	Calibrated Thermometer	Area	Continuous

TABLE A-6
REAL-TIME MONITORING ACTION LEVELS

Compound Monitored	Instrument	Action Level	Response Action
Organic Vapors	Photoionization Detector and/or Flame ionization Detector	Background to 10 ppm Above 10 ppm - 25 ppm > 25 ppm	Level D Level C Evacuate Area
Dust	Respirable Dust Monitor	Background to 1mg/m^3 > 1 mg/m^3	Level D Level C & dust control
LEL	Explosimeter	<10 % >10 %	Level D Evacuate Area or provide ventilation
Oxygen	Oxygen meter	< 19.5 % 19.5 to 23.5% >23.5%	Evacuate Area Level D Evacuate Area
Noise	Sound Level Meter	80 dBA	Hearing Protection
Temperature Extremes	WBGT or Thermometer	See Tables D-2 and D-3	Work/Rest Regimen

TABLE A-7
LEVEL D
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Route of Exposure	Protection Required	Type of PPE
Respiratory	No	
Head	Yes	Hard Hat meeting ANSI Z89.1
Eyes	Yes	Safety glasses (with side shields) meeting ANSI Z87.1
Ears	Yes*	Hearing protectors with adequate Noise Reduction Rating (NRR) (at least 28 NRR)
Hands	Yes*	Leather or sturdy work gloves/Butyl rubber when handling PVC primer and cement
Body	Yes	Employee supplied work uniform
Feet	Yes	Work boot meeting ANSI Z41.1-75 (Steel toe and shank)

* As assigned by the SSHO, based on specific tasks and site conditions.

TABLE A-8
MODIFIED LEVEL C
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Route of Exposure	Protection Required	Type of PPE
Respiratory	Yes	Air purifying, negative pressure, 1/2-face cartridge Respirator with combination cartridge for 1,000 ppm organic vapors and HEPA
Head	Yes	Hard Hat meeting ANSI Z89.1
Eyes	Yes	Safety glasses (with side shields) meeting ANSI Z87.1
Ears	Yes*	Hearing protectors with adequate NRR
Hands	Yes	Work glove of leather/Butyl rubber glove when handling PVC primer and cement
Body	Yes*	Work uniform/Polycoated coverall
Feet	Yes	Work boot meeting ANSI Z41.1-75

* As assigned by the SSHO, based on specific tasks and site conditions.

TABLE A-9
LEVEL B
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Route of Exposure	Protection Required	Type of PPE
Respiratory	Yes	Full Face SCBA/Airline (with 5-minute escape bottle)
Head	Yes	Hard Hat meeting ANSI Z89.1
Eyes	Yes	Full Face SCBA/Airline Respirator
Ears	Yes*	Hearing protectors with adequate NRR
Hands	Yes	Nitrile surgical glove and butyl rubber glove
Body	Yes*	Work coverall/Saranex
Feet	Yes	Work boot meeting ANSI Z41.1-75

* As assigned by the SSHO, based on specific tasks and site conditions.

FIGURES

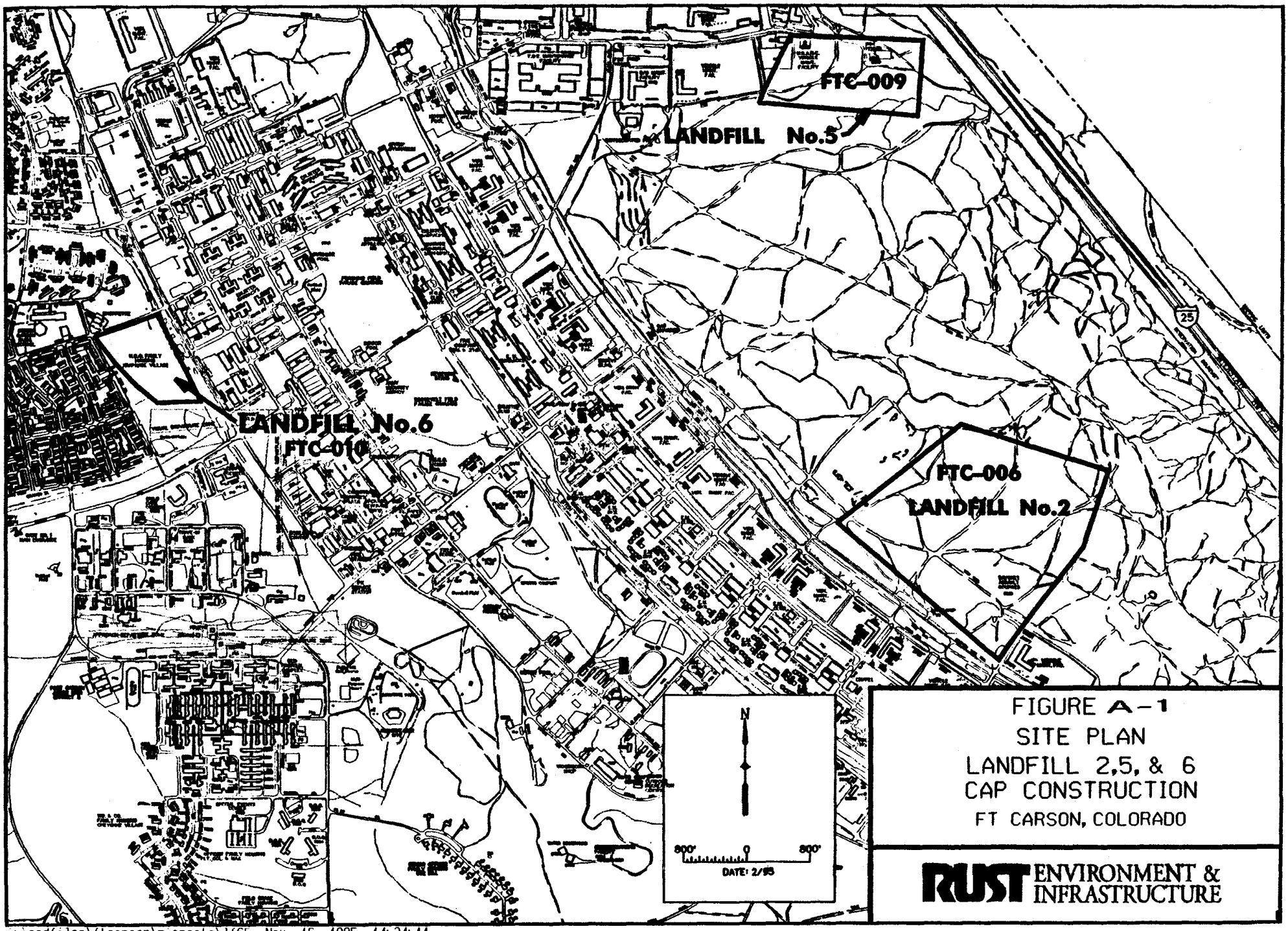
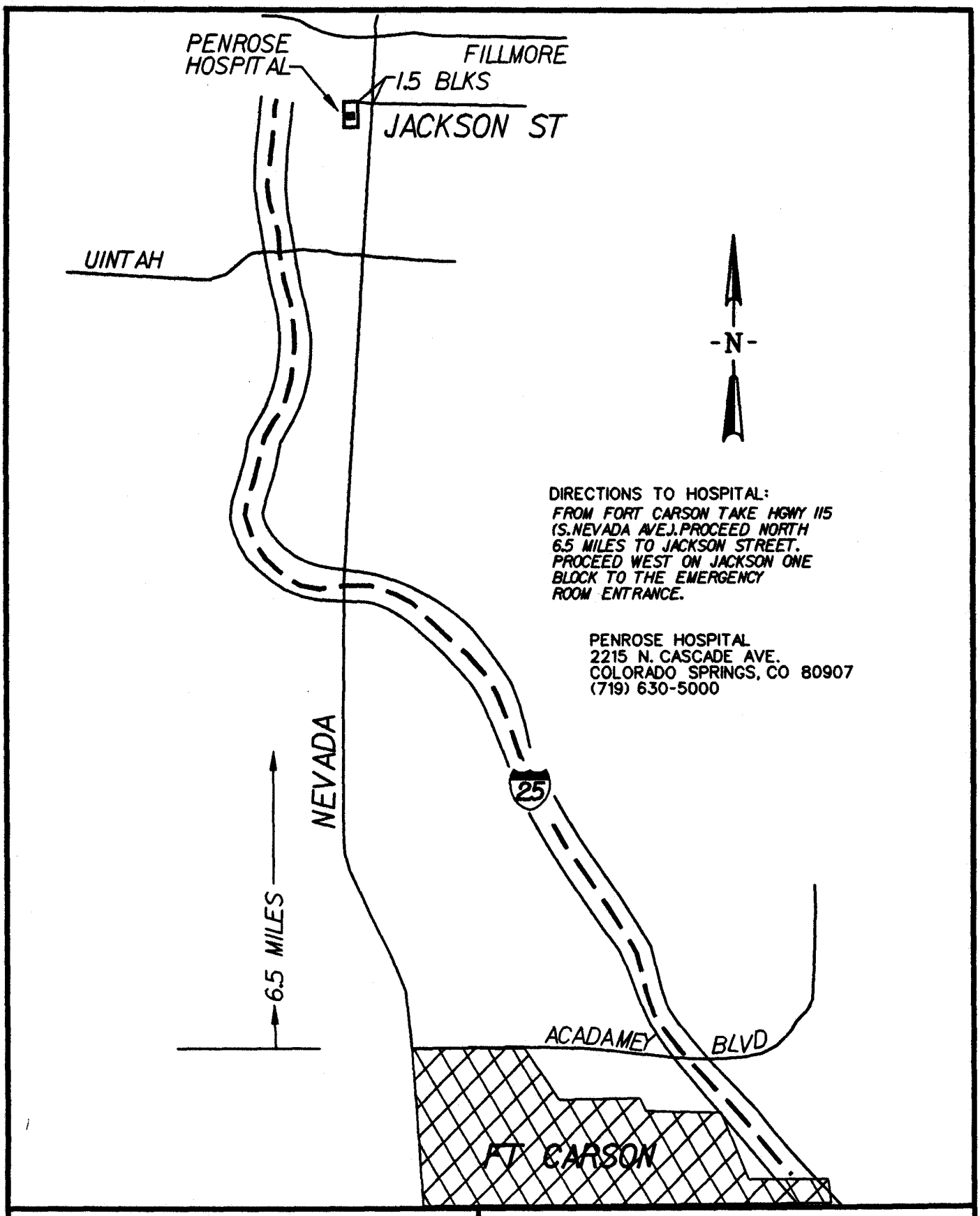


FIGURE A-1
SITE PLAN
LANDFILL 2,5, & 6
CAP CONSTRUCTION
FT CARSON, COLORADO

RUST ENVIRONMENT & INFRASTRUCTURE

\cadfiles\ftcarson\microsta\lf65 Nov. 16, 1995 14:24:11



RUST ENVIRONMENT & INFRASTRUCTURE

FIGURE A-2
DIRECTION TO
OFF-SITE HOSPITAL
FORT CARSON

j:\cadfiles\ftcarson\microsta\hosp Nov. 16, 1995 13:01:11

APPENDIX B

TASK-SPECIFIC ENVIRONMENTAL PROTECTION PLAN

(To be included with 90% Package)

APPENDIX C

DRAFT TASK-SPECIFIC WASTE MANAGEMENT PLAN

DRAFT

TASK-SPECIFIC WASTE MANAGEMENT PLAN

LANDFILLS 2, 5, AND 6 CAP INSTALLATION PROJECT

FORT CARSON, COLORADO

Prepared for:
U.S. Army Corps of Engineers
Omaha District

Prepared by:
Rust Environment & Infrastructure
Englewood, Colorado

Rust Project No. 89868.400
November 1995

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS & ABBREVIATIONS

CFR	Code of Federal Regulations
DOT	Department of Transportation
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
Rust	Rust Environment & Infrastructure
USACE	U.S. Army Corps of Engineers

C1.0 INTRODUCTION

The purpose of this plan is to identify the types of liquid and solid wastes that will be generated during the Landfills 2, 5, and 6 Cap Installation Project, and to establish a waste management method appropriate for each waste type. The wastes are largely the result of construction activities and include non-hazardous soil during landfill delineation activities, cap installation activities, drilling, and well installation. Incidental non-hazardous wastes from site administration and process equipment shipping will also contribute to the total waste produced. The quantities listed in the plan are estimates and may vary somewhat due to unknown field conditions. The vicinity map and site plans for each landfill are presented in the Work Plan for Landfills 2, 5, and 6 Cap Installation.

This plan is organized into five major sections. In addition to this introductory section, Section C2 describes the management of liquid wastes, Section C3 describes the management of solid wastes, Section C4 describes the required documentation, and Section C5 describes onsite storage methods. Sections C2 and C3 include subsections that identify the various waste types, discuss a schedule of generation, identify the waste management method for each waste type, and identify the method of transportation. The plan is designed to be used as a supplement to other project plans such as the Task-Specific Health and Safety Plan and the Task-Specific Environmental Protection Plan.

C2.0 LIQUID WASTE

C2.1 WASTE TYPES AND CHARACTERISTICS

Three types of liquid wastes are likely to be generated in small quantities during construction and installation: potentially contaminated purge water; decontamination rinse water; and non-hazardous incidental wastewater. A description of each waste type is provided in the following paragraphs, and estimated volumes are listed in Table C-1.

C2.1.1 Development/Purge Water

Potentially contaminated development water will be collected at Landfills 2 and 5 during monitoring well construction after the cap has been installed. Purge water will also be generated during groundwater sampling activities at these two landfills. The liquids will be drummed and stored temporarily at each landfill. Samples will not be collected from the development/purge water, but the results of groundwater sampling will be used to evaluate disposal. If the analytical results confirm that the liquid is not a hazardous waste and meets the influent criteria, the waste will be disposed of at the onsite Fort Carson Industrial Waste Water Treatment System.

C2.1.2 Decontamination Rinse Water

Decontamination rinse water will be generated during cleaning of construction equipment, hand tools, disposables, and personal protective equipment (PPE). The rinse water will be contained and collected in a sump, containerized, sampled, and analyzed. If the analytical results confirm that the liquid is not a hazardous waste and meets the influent criteria, it will be disposed of at the onsite Fort Carson Industrial Waste Water Treatment System. The sampling frequency will be based on the type and size of container selected.

C2.1.3 Incidental Wastewater

Incidental non-hazardous wastewater such as sanitary waste, laundry wastewater, and shower wastewater may be generated during the construction activities. Incidental wastewater may be generated at the administration area neighboring the Rust Environment & Infrastructure (Rust) facility trailer. Depending on the final approach to site administration, these wastes may be containerized and stored at the Rust storage trailer compound or fed directly to the sanitary sewer system from

existing permanently plumbed facilities if they exist. Non-hazardous wastewater stored at the Rust storage trailer compound will be picked up and disposed of by a contractor.

C2.2 SCHEDULE OF WASTE GENERATION

Construction activities will be performed for eight hours per day, five days per week unless special circumstances require an extended schedule. Incidental and decontamination wastewater generation is expected during this construction phase. In addition, purge water will be generated during the installation of monitoring wells at each landfill after the caps have been installed.

C2.3 WASTE MANAGEMENT METHODS

Except for incidental wastewater, all liquid wastes will be containerized. The decontamination fluids will be sampled and analyzed to determine the approach for disposal. The groundwater sampling results will be used to evaluate the disposal approach for development fluids and purge water from groundwater monitoring activities. Analytical results will be supplied to Fort Carson and the U.S. Army Corps of Engineers (USACE). Wastewater will be treated at the onsite Fort Carson Waste Water Treatment System if no hazardous wastes are encountered and the influent criteria are achieved, but will be disposed as a hazardous waste in the unlikely event that any hazardous wastes are encountered.

C3.0 SOLID WASTE

C3.1 WASTE TYPES AND CHARACTERISTICS

Five categories of solid waste are anticipated to be generated during the landfill cap construction and are described in the following subsections. Table C-2 summarizes the descriptions, volumes, and management method for each waste type. The majority of solid wastes will be handled as construction debris and will be disposed as gradefill at the individual landfill within the cap being constructed or at the onsite landfill in Fort Carson.

D3.1.1 Excavated Soil Materials Before Cap Installations

Any soils removed during operations prior to completion of cap installation at each respective landfill will be disposed of in that respective landfill. Such operations include trenching, excavating, borehole drilling to delineate landfill parameters, grading, and other miscellaneous unearthing operations.

C3.1.2 Excavated Soil Materials After Cap Installations

Eighteen monitoring wells will be installed after the installation of the caps for Landfills 2 and 5. Soil cuttings will be containerized in 55-gallon Department of Transportation (DOT) drums for storage at each respective operations support area. The materials will be transported to an onsite Fort Carson landfill after a sufficient volume has accumulated. A composite soil sample of these cuttings will be collected for each landfill to confirm that these cuttings can be disposed at the onsite Fort Carson landfill.

C3.1.3 Miscellaneous Construction-Related Debris

Miscellaneous construction debris such as well screen, cement, and plastic sheeting will be generated and disposed in rolloff containers located at the operations support area for each landfill. These wastes will be disposed of at the onsite Fort Carson Landfill.

C3.1.4 Personal Protective Equipment

Most construction activities will be conducted in Level D protection. When activities require an upgrade in PPE, the resulting protective suits, gloves, booties, tape, and respirator cartridges will be

placed in specially marked containers in the process area. Full containers will be sealed, marked, and disposed of at the onsite Fort Carson Landfill. Thirty cubic yards of PPE are anticipated.

C3.1.5 Incidental Wastes

During construction activities, incidental non-hazardous wastes will be generated. These wastes include office waste, lunch room waste, equipment and material packaging, crates, and uncontaminated containers. These wastes will be accumulated in the rolloff container for disposal at the Fort Carson landfill.

C3.2 WASTE MANAGEMENT METHODS

C3.2.1 Hazardous Waste Landfill

Hazard wastes are not anticipated, however, if they are encountered, they will be disposed of appropriately. Five regional hazardous waste landfills were identified as potential disposal facilities for these wastes including the following:

Site Name	Site Location
Rollins (Highway 36)	Colorado
Envirosafe	Idaho
Chemical Waste Management	California
U.S. Ecology	Nevada
USPCI	Utah

Based on preliminary assessments of disposal fees, the Rollins (Highway 36) landfill appears to be the preferred disposal site. Given the small quantities of hazardous solid wastes generated, the drums will be combined with other similar Fort Carson waste shipments as appropriate.

C3.2.2 Onsite Fort Carson Landfill

Up to 85 cubic yards of waste consisting of concrete debris, scrap polyvinyl chloride (PVC), well screen, soil cuttings, plastic sheeting, and incidental wastes will be disposed at the onsite Fort Carson landfill.

C3.3 TRANSPORTATION

C3.3.1 Onsite Transportation

Materials being sent to the onsite Fort Carson landfill will be transported by the appropriate contractor using light trucks, flatbeds, or other appropriate moving equipment. Dump trucks or loaders will be used to transport excavated soil to an appropriate storage area.

C3.3.2 Offsite Transportation

Transportation of hazardous waste to the hazardous waste landfill or industrial waste landfill will be contracted to the respective treatment/disposal contractor. Trucks or railcars will be used as appropriate. Transportation will be in accordance with DOT requirements.

C4.0 DOCUMENTATION

C4.1 WASTE PROFILE

Prior to disposal at a hazardous waste landfill, a waste profile sheet must be completed. Each disposal facility has its own waste profile sheet and analysis requirements; however, many of the forms are similar. The profile sheet includes waste generation information and waste characteristics. The turnaround time may vary depending on the waste type and disposal facility, but generally is less than two weeks.

C4.2 MANIFESTS

A hazardous waste manifest must accompany each shipment of hazardous waste. These manifests will be completed in accordance with 40 Code of Federal Regulations (CFR) 262 Part B and will accompany each hazardous waste load.

C5.0 STORAGE

Drums and rolloff containers will be used for temporary storage of waste. Drummed hazardous wastes will be stored at the operations support area for each respective landfill before a determination has been made regarding disposal options. Any hazardous wastes will then be transported to the onsite hazardous waste storage area or directly to the hazardous waste disposal facility. Non-hazardous waste materials such as construction-related debris and equipment packing materials will be stored directly in rolloff containers or drums at each respective operations support area until the quantities warrant disposal. Drums will be placed on pallets and clearly marked with flags or marking tape.

TABLES

TABLE C-1

LIQUID WASTE GENERATION

Waste Types/Description	Estimated Volume	Anticipated Management Method
Purge Water	18 drums	Fort Carson Industrial Wastewater Treatment System
Decontamination Rinse Water	20,000 gallons	Fort Carson Industrial Wastewater Treatment System
Incidental Wastewater	1,000 gallons	Fort Carson Sanitary Sewer System

Note: Any hazardous wastes encountered will be disposed offsite as hazardous wastes.

TABLE C-2

SOLID WASTE GENERATION

Waste Types/Description	Estimated Volume	Anticipated Management Method
Misc. Construction Debris	15 cubic yards	Fort Carson Waste Landfill
Drill Cuttings	10 cubic yards	Fort Carson Waste Landfill
PPE	30 cubic yards	Fort Carson Waste Landfill
Incidental Wastes	30 cubic yards	Fort Carson Waste Landfill

Note: Any hazardous wastes encountered will be disposed offsite as hazardous wastes.

APPENDIX D
DRAFT CHEMICAL DATA QUALITY MANAGEMENT PLAN

DRAFT

CHEMICAL DATA MANAGEMENT PLAN

LANDFILLS NO. 2, 5, AND 6

FORT CARSON, COLORADO

Contract No. DACW45-93-D-0007
Delivery Order No. 0027

Prepared for:
U.S. Army Corps of Engineers
Omaha District

Prepared by:
Rust Environment & Infrastructure
Englewood, Colorado

Rust Project No. 89868.300
Rev. 0
November 1995

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

ASTM	American Society for Testing and Materials
CDPHE	Colorado Department of Public Health and Environment
COC	Chain of Custody
DECAM	Directorate of Environmental Compliance and Management
DOT	Department of Transportation
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ID	Inside Diameter
LNAPL	Light Non-Aqueous Phase Liquid
mg/l	Milligrams per liter
MRD	Missouri River Division
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
Rust	Rust Environment & Infrastructure
PSHO	Project Safety and Health Officer
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SVOC	Semi-Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
ug/l	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USCS	Unified Soils Classification System
VOC	Volatile Organic Compound

D1.0 INTRODUCTION

The objective of this document is to provide specific guidance for field and laboratory methods to be used for field investigation and monitoring associated with the installation of soil and asphalt caps at Landfills 2 and 5 at Fort Carson Building 8000. Additional pre-design activities are being conducted at Landfill 6 to evaluate the hydrogeologic conditions and the extent of groundwater contamination identified within the landfill, as presented in the Final Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan Addendum for Landfill No. 6 (Rust Environment & Infrastructure (Rust), 1995a). As a result, additional groundwater monitoring activities are not anticipated to be required during the installation of the soil cap at Landfill 6. In the event that additional groundwater monitoring is required at Landfill 6, the sampling procedures outlined in this document will be followed. This document is intended as a supplement to the Field and Laboratory Procedures Manual (Rust, 1995), presenting specific material not covered in that document.

D1.1 GENERAL FACILITY INFORMATION

Fort Carson is located in east-central Colorado, adjacent to the eastern flank of the Rocky Mountain Front Range. The installation is approximately eight miles south of Colorado Springs and 40 miles north of Pueblo, and in its entirety occupies approximately 220 square miles.

Fort Carson is an active military training installation for both weapons qualification and field training, and is home to the 4th Infantry Division (Mechanized). The primary mission of Fort Carson is the training and readiness of all assigned and attached troops to ensure combat-readiness. The principal industrial operation at Fort Carson has been the repair and maintenance of vehicles and aircraft.

D2.0 PROJECT DESCRIPTION

The following sections provide a discussion of the project objective and a summary of the recent pre-design investigation results for Landfills 2 and 5 that are prompting this additional field work.

D2.1 PROJECT OBJECTIVE

The overall objectives of pre-design investigations for Landfills 2, 5, and 6 were to:

- Confirm the horizontal extent of waste materials at each landfill site;
- Evaluate the presence of landfill gas and impact on cap design;
- Investigate the thickness and physical character of existing landfill cover soils;
- Evaluate potential groundwater contamination at each landfill site; and
- Provide geotechnical data necessary for design.

These objectives were evaluated by conducting field mapping, conducting a soil gas survey, drilling soil borings to collect geotechnical samples, conducting a geophysical survey, collecting groundwater direct push samples, and sampling existing monitoring wells. As discussed in Section D1.0, an additional pre-design investigation will be conducted at Landfill 6 to assess the overall hydrogeologic conditions and the nature and extent of groundwater contamination in the vicinity of the landfill. The Draft Design Analysis for Landfill 2 (Rust, 1995b) and the Draft Design Analysis for Landfill 5 (Rust, 1995c) present the results of the field mapping, soil gas survey, geophysical survey, and geotechnical testing, and their impact on the design of the caps for Landfills 2 and 5. However, additional groundwater investigations are required for Landfills 2 and 5 to evaluate known contamination with respect to future remedial design activities at this site. These additional groundwater investigations are discussed in this document.

D2.2 PRE-DESIGN INVESTIGATIONS

A summary of the pre-design investigations conducted to evaluate possible groundwater contamination are presented in the following subsections for Landfills 2 and 5. These pre-design activities consisted of sampling existing wells and collecting direct push groundwater samples. Similar activities were conducted at Landfill 6.

D2.2.1 Landfill 2 Investigations

In order to evaluate the potential impacts on groundwater quality at Landfill 2, six existing monitoring wells were sampled and two direct push groundwater samples were collected in May 1995, and their locations are shown on Figure D2-1. The direct push groundwater test locations were selected on the downgradient side of the landfill, and included test locations at existing drainage swales to sample flows following the natural topography.

The direct push groundwater samples were collected using a hydraulic penetrometer rig, mounted on an all-terrain vehicle. The procedures for collecting direct push groundwater samples are presented in Section D5.3. When auger refusal occurred prior to reaching groundwater, an additional attempt was made to collect a groundwater sample by moving a few feet away and redriving.

The six existing monitoring wells were purged prior to sampling to ensure that representative samples were collected. Prior to purging, the depth to groundwater was measured with an electric water level meter. The purging techniques are discussed in Section D5.4.4. The purge rates were minimized in order to minimize sample turbidity. In low yield wells, a single casing volume was removed, and the water level in the well was allowed to recover prior to sampling.

The groundwater samples from the existing wells and the direct push samples were analyzed for: volatile organic compounds (VOCs) using Method 8260; semivolatile organic compounds (SVOCs) using Method 8270; aluminum, beryllium, boron, cadmium, chromium, copper, iron, lithium, manganese, nickel, vanadium, zinc and silver using Method 6010; arsenic, lead, and selenium using 7000 series graphite furnace AA method; mercury using Method 7471; nitrite using Method 354.1, and nitrite and nitrate using Method 353.2. In cases where the recovery of the well or direct push sample was not adequate to fill all of the sample containers, the containers were filled in the following order: volatile organics, semivolatile organics, and metals.

Results of the groundwater analyses above drinking water standards are posted on Figure D2-1. Copies of original laboratory analytical data are presented in The Draft Design Analysis for Landfill 2 (Rust, 1995b). Metals, antimony, and manganese were detected above drinking water standards

in groundwater from FCMW-75 and FCMW-76, located near the southern, downgradient edge of the landfill. Concentrations ranged from 0.014 to 0.022 milligrams per liter (mg/l) antimony and 4.8 to 6.8 mg/l manganese. Antimony was also detected in groundwater from FCMW-81 at a concentration of 0.021 mg/l; however, these concentrations may be indicative of background levels in groundwater.

The furthest downgradient wells (see inset map on Figure D2-2) contained nitrates above the drinking water standards as indicated in previous sampling. However, none of the wells at the toe of the landfill contained nitrates above drinking water standards.

Organic compounds were detected only in groundwater from downgradient Well FCMW-76. 1,2-Dichloroethane was detected at a concentration of 2.9 micrograms per liter (μg/l), while 1,2 Dichloropropane was detected at a concentration of 3.8 μg/l. No other organic or inorganic parameters were detected above drinking water standards. Additional groundwater sampling will be conducted in this vicinity as discussed in Section D3.1.

Groundwater elevation contour maps for measurements collected in February and June 1995 are presented in Figures D2-2 and D2-3. The top of the Pierre Shale elevation is present on Figure D2-4. Water table contours appear to follow the slope of the top of the Pierre Shale in both winter and summer. The water table is generally below the bottom of the landfilled materials and often is located within the upper portions of the Pierre Shale.

Prior to cap installation, several wells will be abandoned, as shown on Drawing C-8 of the 30% Design Drawings - Landfill 2. Wells FCMW-80 and FCMW-81 will be abandoned by filling with cement/bentonite grout since a 4.5 feet thick cap will be placed over these areas. Wells FCMW-78 and FCMW-79 will also be abandoned if the existing cap in these areas requires reworking.

D2.2.2 Landfill 5 Investigations

In order to evaluate the potential impacts on groundwater quality at Landfill 5, eight existing monitoring wells were sampled and two direct push groundwater samples were collected in May 1995

in locations shown on Figure D2-5. The direct push groundwater test locations were selected on the downgradient side of each site, predominantly between the known limit of waste and the B-ditch or the Post boundary.

The procedures for collecting direct push groundwater samples are presented in Section D5.3. When auger refusal occurred prior to reaching groundwater, an additional attempt was made to collect a groundwater sample by moving a few feet away and redriving.

The eight existing monitoring wells were purged prior to sampling to ensure that representative samples were collected. Prior to purging, the depth to groundwater was measured with an electric water level meter. The purging techniques are discussed in Section D5.4.4. The purge rates were minimized in order to minimize sample turbidity. In low yield wells, a single casing volume was removed, and the water level in the well was allowed to recover prior to sampling.

The groundwater samples from the existing wells and the direct push samples were analyzed for: VOCs using Method 8260; SVOCs using Method 8270; aluminum, beryllium, boron, cadmium, chromium, copper, iron, lithium, manganese, nickel, vanadium, zinc and silver using Method 6010; arsenic, lead, and selenium using 7000 series graphite furnace AA method; mercury using Method 7471; nitrite using Method 354.1, and nitrite and nitrate using Method 353.2. In cases where the recovery of the well or direct push sample was not adequate to fill all of the sample containers, the containers were filled in the following order: volatile organics, semivolatile organics, and metals.

Results of the groundwater analyses above drinking water standards for Landfill 5 are posted on Figure D2-5. Inorganic parameters detected above drinking water standards were found in MW-3, MW-4, MW-5, FCMW-82, and DPW-3, located topographically down slope from the landfill. Parameters detected include antimony, manganese, selenium, and nitrate. Nitrate and selenium were also detected in groundwater from wells MW-1 and MW-2, located in the eastern portion of the landfill and in groundwater from FCMW-84 located upgradient in the northernmost portion of the landfill. Manganese was detected in groundwater from MW-2 as well. Manganese, selenium, and antimony appear to be related to background concentrations. Nitrate concentrations range from 13

to 101 mg/l with the highest levels in upgradient wells. The area around Landfill 5 was formerly used for a mule barn which may account for the high nitrates in the upgradient wells.

Organic parameters were detected above drinking water standards only in groundwater from Well FCMW-82 with a single detection of trichloroethane at a concentration of 5.4 μg/l.

Groundwater elevation contour maps for measurements collected in April and June 1995 are presented in Figures D2-6 and D2-7. The top of Pierre Shale elevation is presented in Figure D2-8. The water table generally follows the slope of the top of the Pierre Shale to the south and east. The water table, in both winter and summer, is below the base of landfill materials and with the upper portion of the Pierre Shale.

Prior to cap construction, Wells FCMW-82 through 85, MW-2, and MW-3 will be abandoned since either an asphalt or soil cap will be placed over these areas. These wells will be abandoned by filling the well with cement/bentonite grout.

D3.0 DATA QUALITY OBJECTIVES

This section presents data quality objectives (DQOs) for each field activity planned for the additional groundwater sampling of Landfills 2 and 5 at Fort Carson. The analytical data level is based on the sampling objective and use of the data. The level of analytical data quality required for each proposed sampling activity is categorized as defined by the U.S. Environmental Protection Agency (EPA) (EPA, 1993) and presented below.

- Field Screening Data is characterized by field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time. It is the least costly of the analytical options, but the least defensible due to the greatest potential for error, and precision and accuracy limitations. This level is normally used for field-investigation health and safety screening, but can also be used to identify media or samples for consideration of further analysis. Field pH, conductivity, temperature, and turbidity measurements which may be used in the Landfills 2 and 5 investigation are included in this level.

- Screening Level Data consists of field analysis using more sophisticated portable analytical instruments than field screening data. There is a wide range in the quality of data that can be generated, depending on the use of suitable calibration standards, reference materials, and sample preparation equipment, and the training of the operator. Results are available in real-time or several hours.

- Definitive Level Data includes all analyses performed in an analytical laboratory located either onsite or offsite using established analytical procedures and strict quality control (QC) procedures. Applicable SW-846 Test Methods for Evaluating Solid Waste and U.S. Army Corps of Engineers (USACE) recommended procedures will be used for the analysis, documentation, and validation. Analytical results produced are analyte specific with confirmation of analyte identity and concentration. The data is generally suitable for use throughout the site assessment, risk assessment, and remedial design process.

D3.1 OVERVIEW OF THE SAMPLING PROGRAM

The field sampling and analysis effort at Landfills 2 and 5 will be performed to assess the overall hydrogeologic conditions, determine the extent of groundwater contamination, and collect data to evaluate future remedial activities, such as the installation of a slurry wall. Field sampling activities will include direct push groundwater sampling and monitoring well installation.

The rationale for the selection of sampling locations, the number of samples to be collected, and specific sampling procedures are discussed in Section D5.0. Quality assurance (QA) objectives for samples in terms of precision, accuracy, representativeness, completeness, and comparability are discussed in the Field and Laboratory Procedures Manual (Rust 1995).

To determine the extent of VOC impacts to groundwater noted in the southeast corner of the Landfill 2, seven direct push water samples will be collected at Landfill 2. In addition, 11 wells will be installed around the perimeter of Landfill 2. Six direct push sample locations are also planned to investigate the detection of trichloroethane at Landfill 5. Based on the results of the direct push sampling, two wells will be installed to provide permanent monitoring points in the area. An additional five wells will be installed around the perimeter of the capped areas of Landfill 5.

D3.2 DATA QUALITY OBJECTIVES FOR FIELD PROGRAM

Direct Push Water Samples (Screening Level Data) - The purpose of direct push water sampling is to screen for organic contaminants that may have impacted shallow groundwater in a discrete portion of each landfill. Seven sampling points will be located in the vicinity of Well FCMW-76 at Landfill 2 and six sampling points will be located in the vicinity of Well FCMW-82 where VOC contamination has been detected in the groundwater. The results of analyses of the direct push water samples will be used in addition to the previous investigation results to locate two permanent monitoring well locations at each landfill that will be suitable for post closure monitoring and to evaluate the extent of groundwater contamination.

The direct push groundwater samples will be collected directly using expendable well points as described in Section D5.3. This method is ideal for screening purposes as it allows groundwater samples to be collected from several locations in a relatively short period of time without the more lengthy process of installing standard monitoring wells. It also allows a groundwater sample to be collected with minimal disturbance to overlying soil; thereby, minimizing impacts to sample integrity. This screening technique will only generate screening data due to the fact that the groundwater is not collected from a completed and developed well.

The water samples will be analyzed offsite by a Missouri River Division (MRD) approved laboratory. Analytical methods, equipment, and instruments are discussed in Section D5.3. Level III documentation will be provided for the direct push water samples; however, the chemical data will be of Level II quality due to the sample collection technique. Direct Push water samples will be collected and analyzed for the following parameters using the referenced EPA methods:

PARAMETER	METHOD
VOCs	8260
SVOCs	8270
Antimony, Cadmium, Chromium, Copper, Manganese, and Barium (filtered)	6010
Nitrite (filtered)	354.1
Nitrite+Nitrate (filtered)	353.2
Arsenic (filtered)	7060
Lead (filtered)	7421
Selenium (filtered)	7740
Mercury (filtered)	7470

Monitoring Wells (Definitive Level Data) - The purpose of monitoring well installation and sampling is to further evaluate the nature and extent of impacts to groundwater in the vicinity of Landfills 2 and 5 and allow for future monitoring of groundwater quality. The new monitoring well locations for Landfill 2 include 11 wells around the perimeter of the landfill. A total of seven monitoring wells will be installed around the perimeter of the capped areas of Landfill 5. The locations for two wells at each landfill will be determined based on the results of the direct push groundwater sampling.

As discussed in Section D5.4.3, pH, specific conductance, temperature, and turbidity will be measured during well development using field equipment. These measurements are considered Level I data.

Groundwater samples will be collected from the new monitoring wells and analyzed for the following parameters using the referenced EPA methods:

PARAMETER	METHOD
VOCs	8260
SVOCs	8270
Antimony, Cadmium, Chromium, Copper, Manganese, and Barium (filtered)	6010
Nitrite (filtered)	354.1
Nitrite+Nitrate (filtered)	353.2
Arsenic (filtered)	7060
Lead (filtered)	7421
Selenium (filtered)	7740
Mercury (filtered)	7470

These analyses will allow for the detection of contaminants which may have leaked from the landfill and impacted the groundwater.

Waste Characterization Sampling (Definitive Level Data) - A composite soil sample for each landfill will be collected from the waste soils generated from drilling monitoring wells at Landfill 2 and 5. The composite soil sample will include a sample from each drum onsite. The purpose of collecting the composite sample is to determine disposal requirements. Based upon the results of analyses performed on these samples, waste soils from the site will be sent to either a Subtitle C or a Subtitle D landfill for disposal.

The composite soil samples will be analyzed for the following parameters using SW-846 methods:

PARAMETER	METHOD
Toxicity Characteristic Leading Procedure (TCLP) For: VOCs, SVOCs, Pesticides/PCBs, Herbicides, and Metals	1311

D4.0 PROJECT ORGANIZATION AND SCHEDULE

Organization of the project and QC responsibility for the field and laboratory work are discussed in the following sections. A description of the responsibilities of each of the key project personnel is also provided. QC responsibility for the field and laboratory work and a description of the responsibilities of each of the key project personnel are provided in the Field and Laboratory Procedures Manual (Rust, 1995).

D4.1 RUST PROJECT ORGANIZATION

The Project Manager, Task Manager, and Field Operations Manager are directly responsible for the project's operations, including implementation of QC procedures. The Program Manager monitors the overall project for compliance with established QA/QC procedures. QA is also provided by independent senior staff reviewers, personnel who are not responsible for the day to day project operations, but have the authority to ensure that project quality objectives are achieved. In this manner, the authority to assure quality is independent from the responsibility for project operations, so that the integrity of project operations and QA is maintained.

D4.2 PROJECT TEAM

The Chief Project Manager is responsible for the overall coordination of Fort Carson related projects, including the sampling and subsequent closure of Landfills 2, 5, and 6. The focal point of the Project Team is the Project Manager, Mr. John England, who is responsible for the overall coordination and successful completion of all activities on this project, both administrative and technical. Mr. England will also be the primary Rust project contact with the USACE and Fort Carson.

Mr. Chuck Luyten will assist Mr. England on this project as the Task Manager. Mr. Luyten will provide day to day coordination and supervision, and has been directly involved with the development of the proposed sampling, and will be directly involved with implementation of field activities and data evaluation.

The Field Operations Manager will be Ms. Caroline Whitesides. Ms. Whitesides will have primary responsibility for the performance and documentation of all field activities and for direct coordination with subcontractors and Post personnel as the field work is conducted. Ms. Whitesides will ensure that personnel assisting with field activities follow the procedures presented in this Work Plan. The Field Operations Manager will also serve as the Site Safety and Health Officer (SSHO) for this work.

The Project Safety and Health Officer (PSHO) is Mr. Michael Ramer. Mr. Ramer is responsible for implementing the project Site Safety and Health Plan (SSHP) and monitoring the project for compliance with SSHP requirements. Mr. Jon Kaibel will assist Mr. Ramer with this responsibility. The PSHO will be alerted in the event that site conditions which might require modifications to the SSHP field operating procedures are encountered. Mr. Ramer or Mr. Kaibel will perform site visits and audit field operations to monitor compliance with SSHP requirements.

D4.2 SCHEDULE

The Final Chemical Data Management Plan will be submitted to Colorado Department of Public Health and Environment (CDPHE) for review, and the field sampling program will be initiated within two weeks of receipt of CDPHE approval. The field sampling program is estimated to require one week for the installation of the 13 groundwater direct push samples and two months for the installation, development and sampling of the 18 wells. Laboratory analytical data are expected to be available within four weeks after completion of field activities. A Draft Hydrogeological Site Investigation Report will be completed and provided to USACE and Fort Carson eight weeks after completion of field activities. Assuming that USACE and Fort Carson review are completed four weeks after receipt of the draft report, the Final Hydrogeological Site Investigation Report will be submitted two weeks after receipt of comments.

D5.0 FIELD SAMPLING AND ANALYSIS

The field investigation will consist of the following activities: site clearance; existing well identification; direct push water sampling; installation and sampling of monitoring wells; installation of stream staff gauges; and surface water sampling. Analytical parameters and the number of groundwater samples to be submitted for chemical analysis from Landfills 2 and 5 are summarized on Table D5-1.

The investigations proposed under this Chemical Data Management Plan emphasize characterization of potential groundwater contamination located down gradient from Landfills 2 and 5. The scope of this investigation is based on previous site investigation results discussed in Section D2.0 of this Work Plan and the Field and Laboratory Procedures Manual (Rust, 1995). These investigations were designed under the direction of CDPHE, USACE, and Fort Carson personnel.

Available analytical data collected previously by the Army's Environmental group and Rust personnel indicate that VOC contamination exists in the groundwater at the edge of Landfills 2 and 5. The proposed field methods and analytical parameters for each of the planned field activities are discussed below. The rationale for proposed sampling locations is also presented. In addition, other procedures contained within the Field and Laboratory Procedures Manual (Rust, 1995) will be followed including: decontamination procedures; field work documentation; sample labeling, handling, and shipping; management of investigation-derived waste; surveying of sampling and well locations; and field equipment preventative maintenance and calibration procedures.

D5.1 SITE CLEARANCE

Prior to mobilization of subcontractors to Landfills 2 and 5 to begin subsurface investigations, the area of investigation will be cleared for underground utilities and structures. Fort Carson personnel will be notified at least two weeks prior to scheduled subsurface activities so that they can mark the locations of subsurface utilities on the pavement, concrete, or ground surface. Facility plans of Landfills 2 and 5 provided by Fort Carson will also be checked for the location of utilities. In addition, a metal detector will be used to confirm the absence of underground utility lines or other

structures at proposed drilling locations. Actual drilling locations will be adjusted as required in the field to avoid utilities or underground obstructions.

D5.2 WELL IDENTIFICATION

Existing groundwater monitoring wells at Landfills 2 and 5 were identified during the pre-design preparation activities. Water level measurements will be collected from the existing wells to generate a groundwater elevation map. Survey coordinates for these existing wells were obtained during the pre-design field programs.

D5.3 DIRECT PUSH WATER SAMPLING

Locations at which the direct push water samples will be collected and the rationale for selection of those locations are discussed initially below. This is followed by a discussion of drilling and sampling methods, sample analysis, and borehole abandonment methods.

D5.3.1 Sampling Locations and Rationale

The results of previous direct push water sampling and monitoring well sampling will be used to identify locations for new direct push water sampling and both Landfills. Groundwater samples will be collected from seven locations at Landfill 2 and six locations at Landfill 5 for screening purposes, to further delineate the lateral extent of contamination, and to aid in the placement of the permanent downgradient onsite groundwater monitoring wells. To determine the extent of VOC impacts to groundwater noted in Well FCMW-76, seven direct push water samples will be collected at Landfill 2. Six direct push sample locations are also planned to investigate the detection of trichloroethane near FCMW-82 at Landfill 5. Exact locations will be determined in the field, although anticipated direct push water locations are shown on Figures D5-1 and D5-2, for Landfills 2 and 5 respectively.

D5.3.2 Drilling and Sampling Methods

Drilling will be performed under the direction of the Rust field geologist. The samples will be collected using a hydraulic penetrometer rig mounted on an all-terrain vehicle. One-inch diameter probing rods with an attached hardened steel expendable point will be hydraulically driven to just below the water table. Water levels will be measured in existing wells and this information will be

used to determine the depth to water. Perforated Polyflow (polyethylene and polybutylene) tubing will be inserted into the rod and screwed into the expendable point. The rods will then be retracted to expose the perforations, allowing water to flow into the tubing. A water sample will then be obtained with a peristaltic pump or inertia valve and poured directly into laboratory-supplied sample containers. The groundwater samples will be analyzed offsite by the contract laboratory. A survey stake, pin flag, or other marker will be left so that the sampling area can be relocated.

Sample information and analytical requirements will be recorded on a chain of custody (COC) form submitted to the contract laboratory. Samples will be placed on ice and chilled to 4°C for the period between collection and analysis.

Depth to groundwater can range from 10 to 25 feet below ground surface based on water level measurements conducted during previous investigations. If refusal occurs prior to reaching groundwater, an additional attempt will be made to collect a groundwater sample by moving a few feet away.

Soil cuttings and discarded water samples will be placed in reconditioned Department of Transportation (DOT)-approved, 55-gallon drums. Labeling and management of the drums is discussed in Section D5.7.

D5.3.3 Water Sample Analysis

Groundwater samples will be analyzed for VOCS and SVOCs using EPA Method 8260 and 8270, respectively. Groundwater samples will also be analyzed for dissolved metals including: antimony, cadmium, chromium, copper, manganese, and barium using EPA Method 6010; arsenic, lead, and selenium using appropriate 7000 series graphite furnace AA methods; and mercury using EPA Method 7470. The samples will also be analyzed for nitrite using EPA Method 354.1 and nitrite/nitrate using EPA Methods 353.2. The samples for metals and inorganics analyses will be field filtered by passing the water through a 0.45 micron disposable filter. Groundwater sample analyses are summarized on Table D5-1. Samples will be shipped to the contract laboratory for analysis.

Sample labeling, handling, and shipping techniques are discussed in the Field and Laboratory Procedures Manual (Rust, 1995).

QC analysis will include method blanks, surrogates, matrix spike/matrix spike duplicates (MS/MSDs), and field duplicates. Instrument and method blanks will be run daily. Five percent of the total number of samples (one sample) will be selected by Rust for MS/MSD analysis for VOCs and SVOCs. Field duplicates will also be collected and analyzed for 5 percent of the total number of samples (one sample). Instrument calibration will also be conducted as described in the Field and Laboratory Procedures Manual (Rust, 1995).

D5.3.4 Abandonment Methods

At each direct push water sampling location, the tubing will be removed and the expendable drive tip will be left in the hole. The small (approximately 2-inch diameter) boreholes created by the direct push water sampling will be abandoned by backfilling with cement grout. The grout will consist of a mixture of Portland cement and water in the proportion of not initially more than 6 gallons of approved water per 94-pound bag of cement. In addition, approximately 3 percent by weight sodium bentonite powder will be added to the mixture.

D5.4 MONITORING WELLS

Monitoring well locations and rationale for their selection are discussed below. This is followed by a discussion of drilling and sampling methods, sample analysis, and borehole abandonment methods.

D5.4.1 Sampling Locations and Rationale

Figure D5-1 presents the location of the 11 wells proposed for Landfill 2. Two monitoring wells will be located downgradient of FCMW-75 and FCMW-76 based on results of the direct push sampling. Two monitoring wells will be installed north or upgradient of the landfill, one well will be installed to the east of FCMW-81 as a replacement well, and six wells will be installed along the western edge of the landfill to evaluate possible impacts from former grit/oil pits. Monitoring well locations will be approved by the USACE-Technical Manager prior to installation.

Figure D5-2 presents the location of the seven wells proposed for Landfill 5. Two monitoring wells will be drilled in the vicinity of Well FCMW-82 based on the results of the direct push groundwater samples. Five additional wells will be installed at Landfill 5. One well will be installed as an upgradient monitoring point along the northern edge of the landfill. Wells will be located near FCMW-83/85, FCMW-82, and MW-2 as replacement wells. One well will be located in the central portion of the landfill, south of the asphalt cap.

D5.4.2 Drilling Methods

An experienced Rust field geologist will continuously supervise, observe, and record all drilling and well construction operations. All drilling will be performed using conventional, truck-mounted drilling rigs, fully equipped for dry hollow-stem auger drilling. Drilling equipment which is not clean prior to site mobilization, or which leaks oil, fuel, or hydraulic fluids, will be removed from the site and cleaned or repaired prior to use.

The work area of the drill rigs, augers, drilling tools, and all down-hole equipment will be steam cleaned prior to use at the site, between borings, and prior to demobilization from the site. Fort Carson will provide a potable water supply for equipment and decontamination. Decontamination of equipment will take place onsite as described in the Field and Laboratory Procedures Manual (Rust, 1995). All decontamination water will be containerized in new labeled 55-gallon drums, pending disposal.

Soil encountered in each boring will be described and logged by the Rust field geologist on the boring log, which is included in the Field and Laboratory Procedures Manual (Rust, 1995). The geologist will use visual/manual techniques described in American Society for Testing and Materials (ASTM) D-2487-92 and D-2488-90, in accordance with the Unified Soils Classification System (USCS). Boreholes for the 2-inch groundwater monitoring wells will be drilled using 3.25-inch inside diameter (ID) hollow stem augers, which will allow sufficient annular space for proper well construction.

Monitoring well screens will be new, threaded, flush joint, 2-inch ID, 0.010-inch continuous wire-wrapped polyvinyl chloride (PVC). Screens will be 10 feet in length and will span the water table.

The riser pipe will be new, threaded, flush joint, 2-inch schedule 40 PVC. All well materials will be steam cleaned immediately prior to installation. Clean, new, disposable rubber gloves will be worn when handling well screens and casings. All well casings and screens will be transported and stored in plastic wrap. Personnel handling these items will not handle tools or drilling equipment while installing the well.

Construction of the monitoring wells will follow the procedure described below:

- The borehole will be advanced with hollow stem augers to the target depth or refusal;
- The lengths of all steam cleaned screen and riser sections, bottom plugs, etc. will be measured and recorded;
- The desired sections of well screen and riser pipe will be assembled and lowered to the bottom of the borehole. Wells will be constructed inside the augers and will bracket the water table with approximately 5 feet of screen below and 5 feet of screen above the water table wherever possible. All wells will be constructed so that potential light nonaqueous phase liquids (LNAPL) floating on the water surface will be detected and monitored, by positioning the screen to straddle the water table.
- Clean silica filter 10-20 sand will be poured through the augers while the augers are pulled back incrementally to construct a continuous filter pack within the borehole annulus. The pack will extend from approximately 1 foot below the well screen to a minimum of 2 feet above the slotted section. The depth to the sand pack will be measured frequently using a properly decontaminated stainless steel tag bar attached to a fiberglass measuring tape to monitor the sand level inside the augers as the filter pack is constructed.
- A 2-foot thick bentonite seal will be constructed by pouring commercially manufactured sodium bentonite pellets or chips through the augers or by tremie, in the manner described above. The bentonite seal will be installed in 6-inch lifts, with each lift hydrated with potable water before proceeding. After placement of the final lift, the granular bentonite seal will be allowed to hydrate for an additional two hours prior to grouting.
- The remaining annular space will be tremie grouted from the top of the bentonite seal to near surface grade with neat cement grout. Grout will consist of not more than six gallons of clean potable water per 94-pound bag of (1 cubic foot) Portland Type I Cement (ASTM C150). Approximately 3 percent (by weight) bentonite powder will be added to improve flow and reduce shrinkage. Tremie grouting may not be necessary if the top of bentonite is 5 feet or less from the surface.

- Well plumbness will be checked in each well using a 10-foot long section of PVC pipe, one-half inch less in diameter than the inner diameter of the well riser pipe. This pipe will be run through the entire length of the well to check the alignment. Results of each test will be indicated on the Daily Quality Control Reports.

The wells will be completed above-ground. A protective steel casing will be installed around the riser pipe extending 2 to 3 feet above the ground surface. The casing will be set and cemented in below ground surface. The casing will be installed such that it does not hinder collection of groundwater samples from the well. The casing will contain a locking cap and a brass lock, keyed alike to other wells installed as part of this project. All protective casings will be designed with a weep hole to facilitate drainage of any water which could collect in the annular space between the well riser and protective casing. The outside of the protective casing will be painted white as specified by the Directorate of Environmental Compliance and Management (DECAM). Identification tags containing well number, total depth of well, and date of installation, adjusted top of casing elevation, and "U.S. Army Corps of Engineers, Omaha District" will be attached to each new monitoring well.

A concrete pad, a minimum of 3 feet on each side and 4 inches in thickness, will be constructed, sloping away from the well. Three, approximately 3-inch diameter posts, equally spaced around the well and filled with cement, will be cemented firmly into the ground around the concrete pad to protect the well.

D5.4.3 Monitoring Well Development Methods

Wells will be finished and grouted before the commencement of well development in order to avoid inadvertent well destruction by heavy machinery traffic in the vicinity of the proposed well locations. Well development will commence within one week of well completion, but not before 48 hours after well completion, to ensure that the grout has set. The objectives of well development are to:

- Assure that groundwater enters the well screen freely, thus yielding a representative groundwater sample and accurate groundwater level measurement;
- Remove all water that may have been introduced during drilling and well installation; and
- Remove fine grained sediment from the filter pack and nearby formation so that groundwater samples are not highly turbid and that silting of the well does not occur.

Well development will be accomplished by a combination of methods, which will include mechanical surging and bailing for a period of two hours, followed by continuous pumping using a pneumatic drive positive displacement piston pump. Groundwater temperature, pH, specific conductance, and turbidity will be monitored as indicator parameters during pumping, at appropriate frequencies ranging from one measurement per each casing volume removed (wells with low yields) to one measurement every 15 minutes (wells with higher yields). Development will continue until most suspended solids are removed and the indicator parameters stabilize at less than 0.2 pH units or a 10 percent deviation from the average of four successive measurements. If these parameters have not stabilized after four hours of continuous pumping, the USACE will be contacted for further direction. If water is introduced during drilling or installation procedures, an equal or greater amount of water will be removed during development. If LNAPLs are found in the well, the USACE-Technical Manager and Fort Carson-Remedial Program Manager will be notified before any development activities are conducted. If well yields are too low to permit continuous pumping or bailing, then development will be discontinued when the well is bailed dry, and the USACE-Technical Manager will be contacted for further direction.

After final development of any new well, one liter of water will be collected from the well in a clear glass jar, and the water sample will be labeled and photographed. The photographs (or color slides) will be submitted to the USACE along with the final well construction logs.

Well development information will be recorded on the Well Development Record shown in the Field and Laboratory Procedures Manual (Rust, 1995). Information provided on the Well Development Record will include:

- Name of project and site, well identification number, and date(s);
- Date, time, and elevation of the static water level and bottom of well before development;
- Method used for development, to include equipment, size, type and make of bailer and/or pump used during development;
- Time spent developing the well by each method, to include the typical pumping rate if a pump was used in development;

- Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor;
- Volume and source of any water added to the well, and chemical analysis of the added water;
- Volume and physical character of sediment removed, to include changes during development in color and odor;
- Clarity of water before, during, and after development, including a backlit photo, and depth of any sediment which settles to the bottom of the jar containing the last one liter of water withdrawn from the well during development;
- Total depth of well and the static water level immediately after, and 24 consecutive hours after development;
- Readings of pH, specific conductance, temperature, and turbidity taken before, during, and after development;
- Name(s) and job title of individual(s) developing well; and
- Name and/or description of the disposal facility/area for the waters removed during development.

All well development fluids will be contained in new DOT-approved 55-gallon drums for eventual disposal.

D5.4.4 Monitoring Well Purging and Sampling Procedures

One suite of groundwater samples will be collected from each of the new monitoring wells. Groundwater samples will be collected no sooner than two weeks following well development. All equipment used for water level measurement, well purging, and groundwater sampling, will be decontaminated prior to use, in accordance to the procedures described in the Field and Laboratory Procedures Manual (Rust, 1995). Sampling personnel will don new nitrile gloves prior to the initiation of sampling activities at each well site. Groundwater sampling data for all wells monitored, including a description of the sampling locations, names of the sampling personnel, ambient weather conditions, environmental conditions that may affect sample representativeness, indicator parameter measurements, and well purging information will be recorded on the Groundwater Sample Collection Log presented in the Field and Laboratory Procedures Manual (Rust, 1995). The visible monitoring

well construction materials and the apparent integrity of each well will also be evaluated and noted.

Each well will be purged prior to sampling to ensure that samples collected are representative. Prior to purging, the groundwater elevation and total well depth will be measured using a water level meter. The elevation shall be measured from the top of the well riser pipe or a permanent mark on the well casing, and shall be determined to an accuracy of $\pm$ 0.01 foot. If any LNAPL is found in the well, the USACE-Technical Manager and the Fort Carson-Remedial Program Manager will be notified before any further activities take place at the well; however, a sample of the LNAPL will be collected and analyzed.

Each well will be purged prior to sampling until at least three well volumes have been removed and field parameters (pH, temperature, specific conductance, and turbidity) have stabilized to 0.2 pH units or a 10 percent variation around the mean of four successive measurements. Field parameters will be measured at the start of purging and twice per casing volume removed or once every 15 minutes, depending on the well yield. Alternatively, purging will cease when the well is purged dry.

Purging will be accomplished using a decontaminated pneumatic drive positive displacement piston-driven pump, or with a clean, disposable PVC or decontaminated stainless steel bailer, attached to a new, clean nylon or polypropylene rope. No purging shall be conducted on wells that possess LNAPLs. In this event, a sample of the LNAPL will be collected and analyzed.

Sampling will typically be conducted immediately after purging, and no later than three hours following purging unless recharge of the well requires a longer time span. All samples will be subject to COC protocols. All samples will be immediately placed on ice in a cooler and preserved at a temperature of 4°C.

The piston pump, disposable PVC bailers, or a decontaminated stainless steel bailer, will be used to collect the groundwater samples into laboratory-supplied pre-preserved and unpreserved sampling containers. The pump leads or rope shall not be allowed to contact the ground during purging or sampling procedure, and the rope will be discarded after each use. Dedicated nylon or polypropylene

rope will be used to lower and retrieve the bailer from the well. The following procedures shall be followed when sampling:

- Sampling equipment shall be inspected and approved as clean and in working order;
- New, clean plastic sheeting shall be spread about the well, so that sampling equipment will not become contaminated by contact with the ground surface or vegetation;
- The sample shall be slowly poured from the pump or the bailer directly into the sample bottle along its edge, in order to minimize aeration;
- VOC bottleware will be filled to the point of creating a convex meniscus, and then sealed with a Teflon-lined septum lid. The teflon side of the lid shall contact the sample, and no headspace shall remain in the vial; and
- The VOC vial will be inverted and lightly tapped following sample collection and sealing, in order to locate air bubbles in the sample. If bubbles are present, the vial may be unsealed and additional sample may be added in order to completely eliminate vapor headspace. The vial will again be sealed as described above. Additional sample may be added no more than three times. If bubbles remain in the vial after three attempts to add additional sample volume, then the vial and septum will be discarded and a new vial must be used.

Each sample will be carefully labeled so that it can be properly identified by laboratory personnel. The sample label will include the sample number, analyses requested, preservation/filtering information, time, date, and sampler's initials.

D5.4.5 Groundwater Sample Analysis

Groundwater samples will be analyzed for VOCS and SVOCs using EPA Method 8260 and 8270, respectively. Groundwater samples will also be analyzed for dissolved metals including: antimony, cadmium, chromium, copper, manganese, and barium using EPA Method 6010; arsenic, lead, and selenium using appropriate 7000 series graphite furnace AA methods; and mercury using EPA Method 7470. The samples will also be analyzed for nitrite using EPA Method 354.1 and nitrite/nitrate using EPA Methods 353.2. The samples for metals and inorganics analyses will be field filtered by passing the water through a 0.45 micron disposable filter. Groundwater sample analyses are summarized on Table D5-1. Samples will be shipped to the contract laboratory for analysis.

Sample labeling, handling, and shipping techniques are discussed in the Field and Laboratory Procedures Manual (Rust, 1995).

QC analysis will include method blanks, surrogates, MS/MSDs, and field duplicates. Instrument and method blanks will be run daily. Five percent of the total number of samples (one sample) will be selected by Rust for MS/MSD analysis for VOCs and SVOCs. Field duplicates will also be collected and analyzed for 5 percent of the total number of samples (one sample). Instrument calibration will also be conducted as described in the Field and Laboratory Procedures Manual (Rust, 1995).

D5.6 SAMPLE DESIGNATION

Each groundwater sample will be labeled with a unique identification number. This number will have three components which are described below:

- Site Identification: The Landfill 2 samples will be identified as "LF2", and Landfill 5 samples will be identified as "LF5".

- Sample Type Identifier: A two or three character code will be used to identify the type of sample collected. The codes to be used are as follows:

  DPW - Direct Push Water
  MW - Monitoring Well

- Sample Location Number: A unique number will be used to identify each sampling location. The numbers will be sequential.

  Following is an example of some sample designations that will be used for the samples collected from Landfill No. 2:

DIRECT PUSH WATER	MONITORING WELLS
LF2-DPW5	LF2-MW1
LF2-DPW6	LF2-MW2
etc.	etc.

D5.6 MANAGEMENT OF INVESTIGATION DERIVED WASTES

Soil cuttings will be placed in reconditioned DOT-approved 55-gallon drums. The drums will be sealed, labeled, and stored onsite at each landfill for the duration of the field activities. At the end of the sampling effort, composite waste characterization samples will be collected from the soil drums. An aliquot of soil will be collected from each of the soil drums in a single sample container for TCLP VOC analysis. The remaining samples will be collected by mixing some soil from each drum in a stainless steel bowl and then composite samples will be collected in the appropriate sample containers.

Waste water, including decontamination, well development, and purge water, will also be containerized in new, 55-gallon drums. The drums of waste water from decontamination and development/purging will not be sampled. Disposal of the contents of these waste water drums will be decided by evaluating the groundwater sampling results.

D6.0 ANALYTICAL PROCEDURES

Analytical procedures and QA/QC procedures will be in accordance with those detailed in Section 6.0 of the Field and Laboratory Procedures Manual (Rust, 1995). Analytical samples will be sent to Quanterra Analytical Services located in Arvada, Colorado. Sample container, preservation, and holding time specifications are presented on Table D6-1, and the laboratory quality assurance program plan (QAPP) is available in Appendix B of the Grit/Oil Pit RCRA Facility Investigation Work Plan.

D7.0 DATA REDUCTION, VALIDATION, AND REPORTING

Refer to the Field and Laboratory Procedures Manual (Rust, 1995) for a discussion on data reduction, validation, and reporting.

D8.0 PERFORMANCE AND SYSTEMS AUDITS

The performance and systems audits of field screening and sampling activities are detailed in the Field and Laboratory Procedures Manual (Rust, 1995).

D9.0 REFERENCES

Rust Environment & Infrastructure (Rust). November, 1994. Final Sampling and Analysis Plan and Site Specific Health and Safety Plan for Fire Training Area, Fort Carson, Colorado.

Rust. September, 1995. Working Draft Field and Laboratory Procedures Manual, Fort Carson, Colorado.

Rust. November, 1995a. Final RCRA Facility Investigation Work Plan Addendum for Landfill No. 6, Fort Carson, Colorado.

Rust. November, 1995b. Draft Design Analysis for Landfill 2, Fort Carson, Colorado.

Rust. November, 1995c. Draft Design Analysis for Landfill 5, Fort Carson, Colorado.

U.S Army Corps of Engineers, Omaha District. May, 1993. "Chemistry, General Scope of Services."

U.S. Army Corps of Engineers. May, 1992. "Geology Scope of Services."

U.S. Army Corps of Engineers. October 1, 1990. "Chemical Data Quality Management for Hazardous Waste Remedial Activities. Appendix D: Guide to the Preparation of the Chemical Data Acquisition Plan." USACE ER-1110-1-263.

U.S. Environmental Protection Agency. 1987. Data Quality Objectives for Remedial Response Activities. Development Process. Office of Emergency and Remedial Response and Office of Waste Programs Enforcement. EPA/540/G-87/003.

TABLES

TABLE D5-1
GROUND WATER SAMPLING SUMMARY
LANDFILLS 2 AND 5
FORT CARSON, COLORADO

Sample Type	Volatile Organic Compounds EPA Method 8260	Semivolatile Organic Compounds EPA Method 8270	Metals (Cd, Cr, Ag, Ba,Sb,Mn) EPA Method 6010	Metals (As, Pb, Se) EPA Method 7000	Mercury EPA Method 7470	Nitrite EPA Method 354.1	Nitrate/ Nitrite EPA Method 353.2	TCLP (Soil Cuttings)
Landfill 2								
Direct Push Water	7	7	7	7	7	7	7	
Monitoring Well	11	11	11	11	11	11	11	1
Field Duplicate	1	1	1	1	1			
Trip Blank (Quanterra)	3							
MS/MSD	1	1	1	1	1			
Split (MRD Lab)	1	1	1	1	1			
Trip Blank (MRD Lab)	1							
Landfill 5								
Direct Push Water	6	6	6	6	6	6	6	
Monitoring Well	7	7	7	7	7	7	7	1
Field Duplicate	1	1	1	1	1			
Trip Blank (Quanterra)	3							
MS/MSD	1	1	1	1	1			
Split (MRD Lab)	1	1	1	1	1			
Trip Blank (MRD Lab)	1							

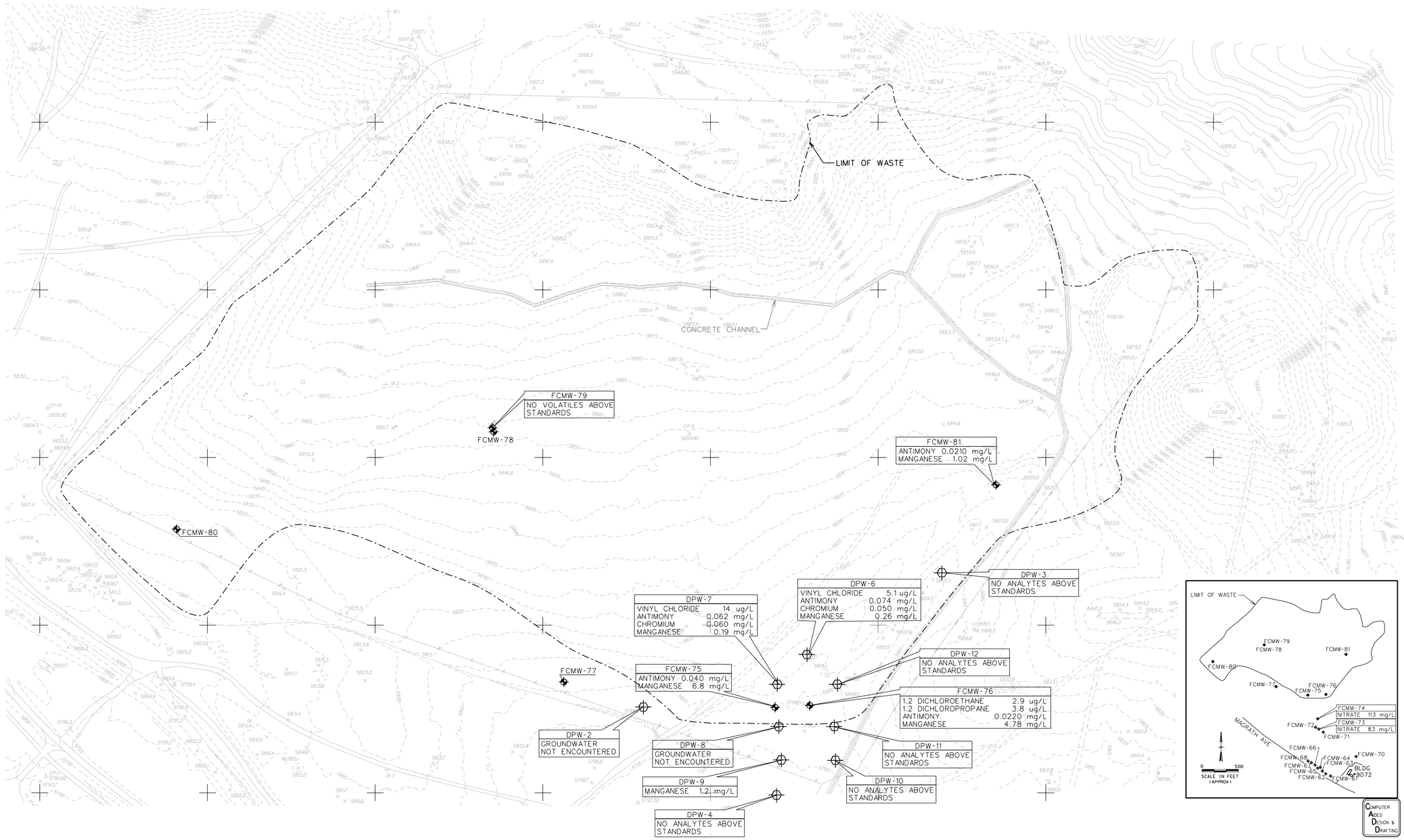
MRD USACE Missouri River Division Laboratory
MS Matrix Spike
MSD Matrix Spike Duplicate
TCLP Toxicity Characteristic Leaching Procedure (VOCs, SVOCs, PCBs/Pesticides, Herbicides, RCRA Metals)

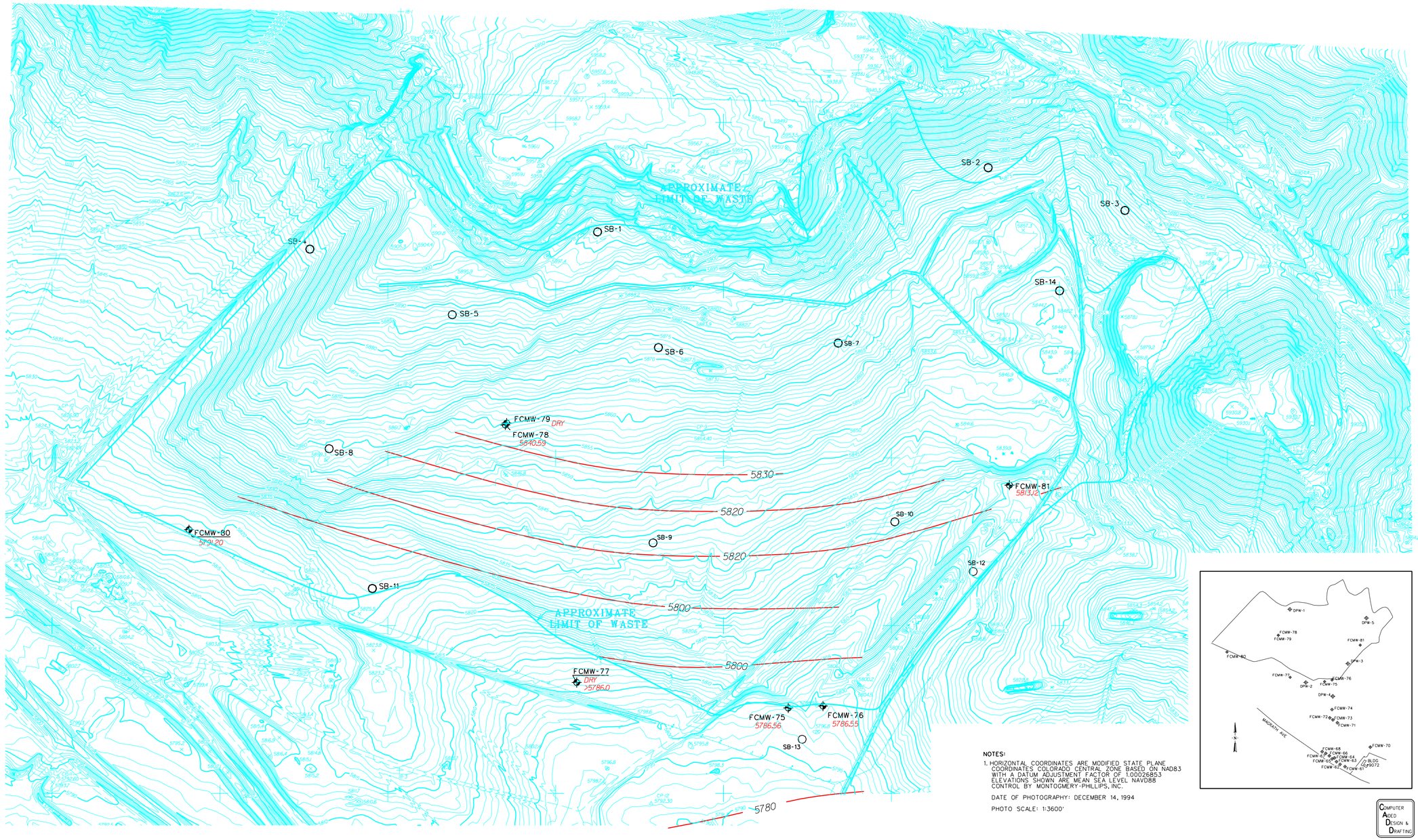
TABLE D6-1
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME SPECIFICATIONS
LANDFILLS 2 AND 5
FORT CARSON, COLORADO

Method	Parameter	Container[a]	Volume Required (ml)	Preservation	Maximum Holding Times[b](days)
GROUND WATER ANALYSIS					
Organic Methods					
8260	Volatile Organics	G; Teflon® lined septum	4x40	4°C; HCL to pH<2	14
8270	Semivolatile Organics	Amber G; Teflon® lined cap	1000	4°C	7/40
Inorganic Methods					
7470	Mercury	Plastic	500	4°C; HNO_3 to pH<2	28
7000	GFAA Metals	Plastic	250	4°C;HNO_3 to pH<2	180
6010	Metals	Plastic	1000	4°C;HNO_3 to pH<2	180
354.1	Nitrite	Plastic	250	4°C	48 hour
353.2	Nitrate/Nitrite	Glass	250	4°C;HNO_3 to pH<2	28
SOIL ANALYSIS					
1311[c]	TCLP (VOCs)	G;Teflon® lined septum	10	4°C	14
1311[c]	TCLP (SVOCs)	Amber G;Teflon® lined cap	100	4°C	14/40
1311[c]	TCLP (Pesticides/PCBs)	Amber G;Teflon® lined septum	100	4°C	7/40
1311[c]	TCLP (Herbicides)	Teflon® lined septum	100	4°C	7/40
1311[c]	TCLP (Metals)	Plastic	100	4°C	180

Notes:
NA Not applicable.
TBD To be determined.
7/40 Extraction within 7 days and analysis within 40 days.
[a] G=Glass
[b] Holding times are calculated from the date of collection.
[c] TCLP analyses performed using 1311 extraction method and applicable analysis method.

FIGURES


3209000 E
3209500 E
3210000 E
3210500 E
3211000 E
3211500 E
3212000 E
3212500 E
1332500 N
1332000 N
1331500 N
1331000 N
1330500 N
LIMIT OF WASTE
CONCRETE CHANNEL
FCMW-79
NO VOLATILES ABOVE STANDARDS
FCMW-78
FCMW-81
ANTIMONY 0.0210 mg/L
MANGANESE 1.02 mg/L
FCMW-80
DPW-7
VINYL CHLORIDE 14 ug/L
ANTIMONY 0.062 mg/L
CHROMIUM 0.060 mg/L
MANGANESE 0.19 mg/L
DPW-6
VINYL CHLORIDE 5.1 ug/L
ANTIMONY 0.074 mg/L
CHROMIUM 0.050 mg/L
MANGANESE 0.26 mg/L
DPW-3
NO ANALYTES ABOVE STANDARDS
DPW-12
NO ANALYTES ABOVE STANDARDS
FCMW-77
FCMW-75
ANTIMONY 0.040 mg/L
MANGANESE 6.8 mg/L
FCMW-76
1,2 DICHLOROETHANE 2.9 ug/L
1,2 DICHLOROPROPANE 3.8 ug/L
ANTIMONY 0.0220 mg/L
MANGANESE 4.78 mg/L
DPW-2
GROUNDWATER NOT ENCOUNTERED
DPW-8
GROUNDWATER NOT ENCOUNTERED
DPW-11
NO ANALYTES ABOVE STANDARDS
DPW-9
MANGANESE 1.2 mg/L
DPW-10
NO ANALYTES ABOVE STANDARDS
DPW-4
NO ANALYTES ABOVE STANDARDS
LEGEND
FCMW-81 LOCATION OF EXISTING MONITORING WELL
DPW-3 APPROXIMATE DIRECT PUSH WATER SAMPLING LOCATION
SURVEY CONTROL POINT
LIMIT OF WASTE
N
SCALE: 1 INCH = 200 FEET
100' 0 100'
NOTES:
1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTOGMERY-PHILLIPS, INC.
DATE OF PHOTOGRAPHY: DECEMBER 14, 1994
PHOTO SCALE: 1:3600'
2. MONITORING WELLS FCMW-73, FCMW-74, FCMW-75, FCMW-76, FCMW-79, AND FCMW-81, AND DIRECT PUSH SAMPLE LOCATIONS DPW-2, DPW-3, AND DPW-4 WERE SAMPLED IN MAY AND JUNE 1995.
3. DIRECT PUSH SAMPLE LOCATIONS DPW-6 THROUGH DPW-12 WERE SAMPLED IN MARCH OF 1996.
LIMIT OF WASTE
FCMW-79
FCMW-78
FCMW-81
FCMW-80
FCMW-77
FCMW-76
FCMW-75
FCMW-74
NITRATE 11.3 mg/L
FCMW-73
NITRATE 8.3 mg/L
FCMW-72
FCMW-71
FCMW-66
FCMW-68
FCMW-64
FCMW-62
FCMW-70
FCMW-65
FCMW-63
BLDG 49072
FCMW-67
FCMW-61
MAGRATH AVE
N
0 500
SCALE IN FEET (APPROX.)
$$ – THINK VALUE ENGINEERING – $$
Revisions
Symbol | Description | Date | Approved
EARTH TECH
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA
Designed by: KR
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:
FIGURE 6 D2-1
ANALYTES ABOVE DRINKING WATER STANDARDS
LANDFILL No.2 (FTC-006)
Plot Scale Ratio: AS SHOWN
Design File: LF2FIG6.DGN
Date: JUNE 2000
Spec. No.:
Drawing Code:
Contract No.: DACW 45
Sheet reference number:
COMPUTER AIDED DESIGN & DRAFTING



LEGEND

- FCMW-81 — LOCATION OF EXISTING MONITORING WELL
- SB-3 — LOCATION OF BORING
- SURVEY CONTROL POINT
- APPROXIMATE LIMIT OF WASTE
- 5810 — WATER ELEVATION 2/16/95

N

SCALE: 1 INCH = 100 FEET
100' 0 100'

NOTES:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES, COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.000026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

COMPUTER AIDED DESIGN & DRAFTING

$$ – THINK VALUE ENGINEERING – $$

Revisions			
Symbol	Descriptions	Date	Approved

EARTH TECH
MOUNTAIN STATISTICIAN

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

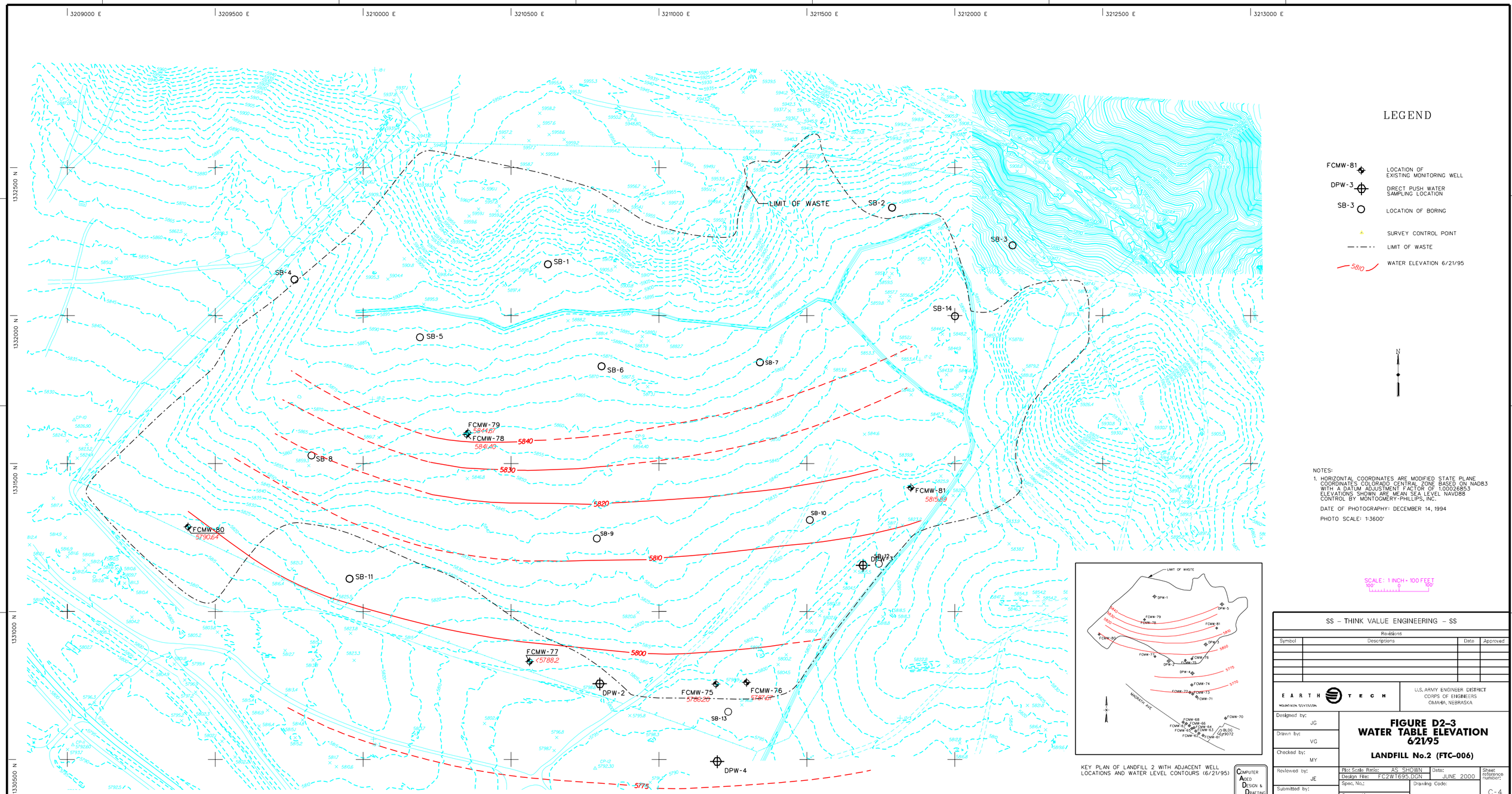
Designed by: KW
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

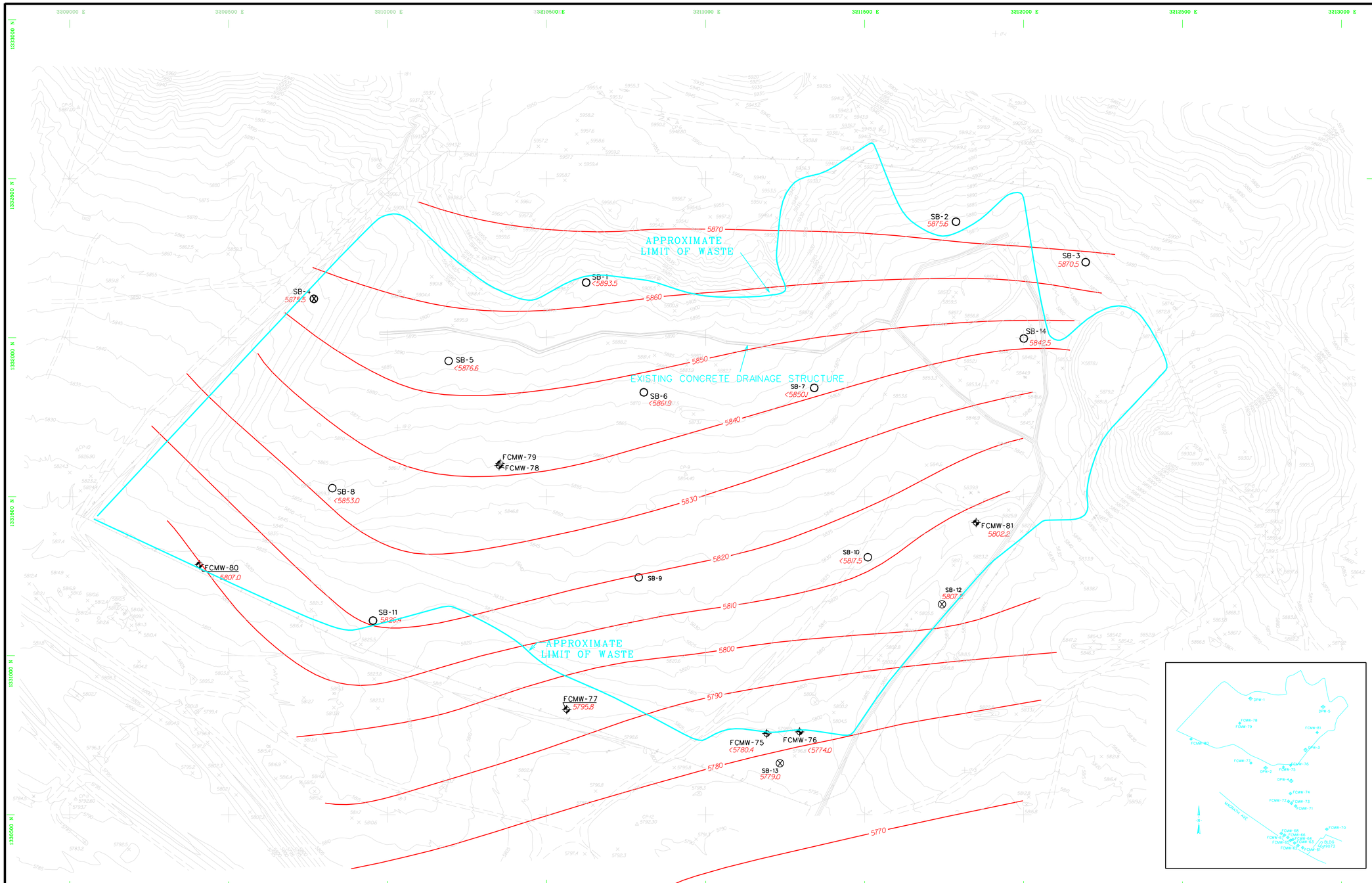
WATER TABLE ELEVATION 2/16/95

LANDFILL No.2 (FTC-006)

Plot Scale Ratio: AS SHOWN
Date: JUNE 2000
Design File: FC2WT295.DGN
Spec. No.:
Drawing Code:
Contract No.: DACW 45

Sheet reference number: C-6


3209000 E
3209500 E
3210000 E
3210500 E
3211000 E
3211500 E
3212000 E
3212500 E
3213000 E
1332500 N
1332000 N
1331500 N
1331000 N
1330500 N
LIMIT OF WASTE
SB-1
SB-2
SB-3
SB-4
SB-5
SB-6
SB-7
SB-8
SB-9
SB-10
SB-11
SB-12
SB-13
SB-14
DPW-1
DPW-2
DPW-3
DPW-4
DPW-5
FCMW-75
5766.20
FCMW-76
5781.67
FCMW-77
<5788.2
FCMW-78
5841.40
FCMW-79
5844.67
FCMW-80
5790.64
FCMW-81
5815.88
5840
5830
5820
5810
5800
5775
LEGEND
FCMW-81
LOCATION OF EXISTING MONITORING WELL
DPW-3
DIRECT PUSH WATER SAMPLING LOCATION
SB-3
LOCATION OF BORING
SURVEY CONTROL POINT
LIMIT OF WASTE
5810
WATER ELEVATION 6/21/95
N
NOTES:
1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.
DATE OF PHOTOGRAPHY: DECEMBER 14, 1994
PHOTO SCALE: 1:3600'
SCALE: 1 INCH = 100 FEET
100' 0 100'
KEY PLAN OF LANDFILL 2 WITH ADJACENT WELL LOCATIONS AND WATER LEVEL CONTOURS (6/21/95)
COMPUTER AIDED DESIGN & DRAFTING
$$ – THINK VALUE ENGINEERING – $$
Revisions
Symbol
Description
Date
Approved
EARTH TECH
MOUNTAIN STATES DIVISION
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA
Designed by: JG
Drawn by: VG
Checked by: MY
Reviewed by: JE
Submitted by:
FIGURE D2-3
WATER TABLE ELEVATION
6/21/95
LANDFILL No.2 (FTC-006)
Plot Scale Ratio: AS SHOWN
Date: JUNE 2000
Design File: FC2WT695.DGN
Spec. No.:
Drawing Code:
Contract No.: DACW 45
Sheet reference number: C-4



LEGEND

FCMW-81 — APPROXIMATE LOCATION OF EXISTING MONITORING WELL

SB-3 — APPROXIMATE LOCATION OF SHALLOW BORING

SB-12 — APPROXIMATE LOCATION OF DEEP BORING

SURVEY CONTROL POINT

LIMITS OF BOUNDARY TO BE VERIFIED BY FIELD STUDY

5810 — TOP OF PIERRE ELEVATION

N

HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.000268853
ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

SCALE: 1 INCH = 200 FEET
100' 0 100'

$$-THINK VALUE ENGINEERING-$$

Revisions

Symbol	Descriptions	Date	Approved

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by:
Drawn by:
Checked by:
Reviewed by:
Submitted by:
Chief: Section

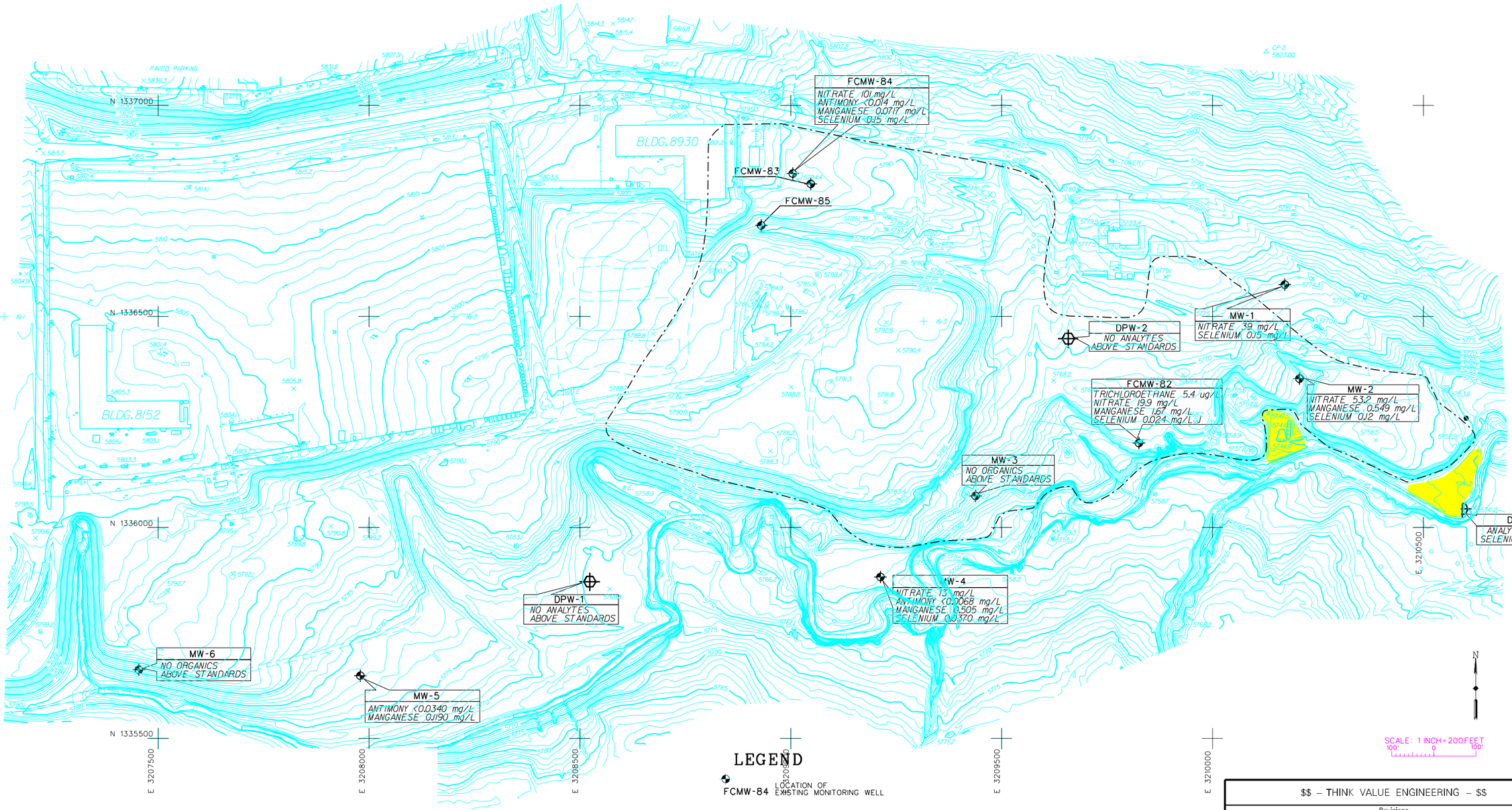
FORT CARSON COLORADO

FIGURE D2-4

TOP OF PIERRE SHALE

LANDFILL No.2 (FTC-006)

Plot Scale Ratio:
Design File: LF2FIG5.DGN
Date: 10/16/95
Spec.No.:
Drawing Code:
Contract No.: DACW 45-93-D-0007
Sheet reference number:



LEGEND

FCMW-84 — LOCATION OF EXISTING MONITORING WELL

DIRECT PUSH WATER SAMPLE LOCATION

ESTIMATED LIMITS OF LANDFILL MATERIAL

CONTOUR INTERVAL IS 1 FOOT

NOTE:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853
ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
CONTROL BY MONTGOMERY-PHILLIPS, INC.
DATE OF PHOTOGRAPHY: DECEMBER 14, 1994
PHOTO SCALE: 1:3960'

NOTES:

1. GROUND WATER SAMPLES TESTED FOR VOLATILE ORGANICS, (METHOD 8260) SEMIVOLATILE ORGANICS (METHOD 8270) AND DISSOLVED METALS UNLESS OTHERWISE NOTED

J DENOTES ANALYTE DETECTED BETWEEN MDL AND PQL

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: ES
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

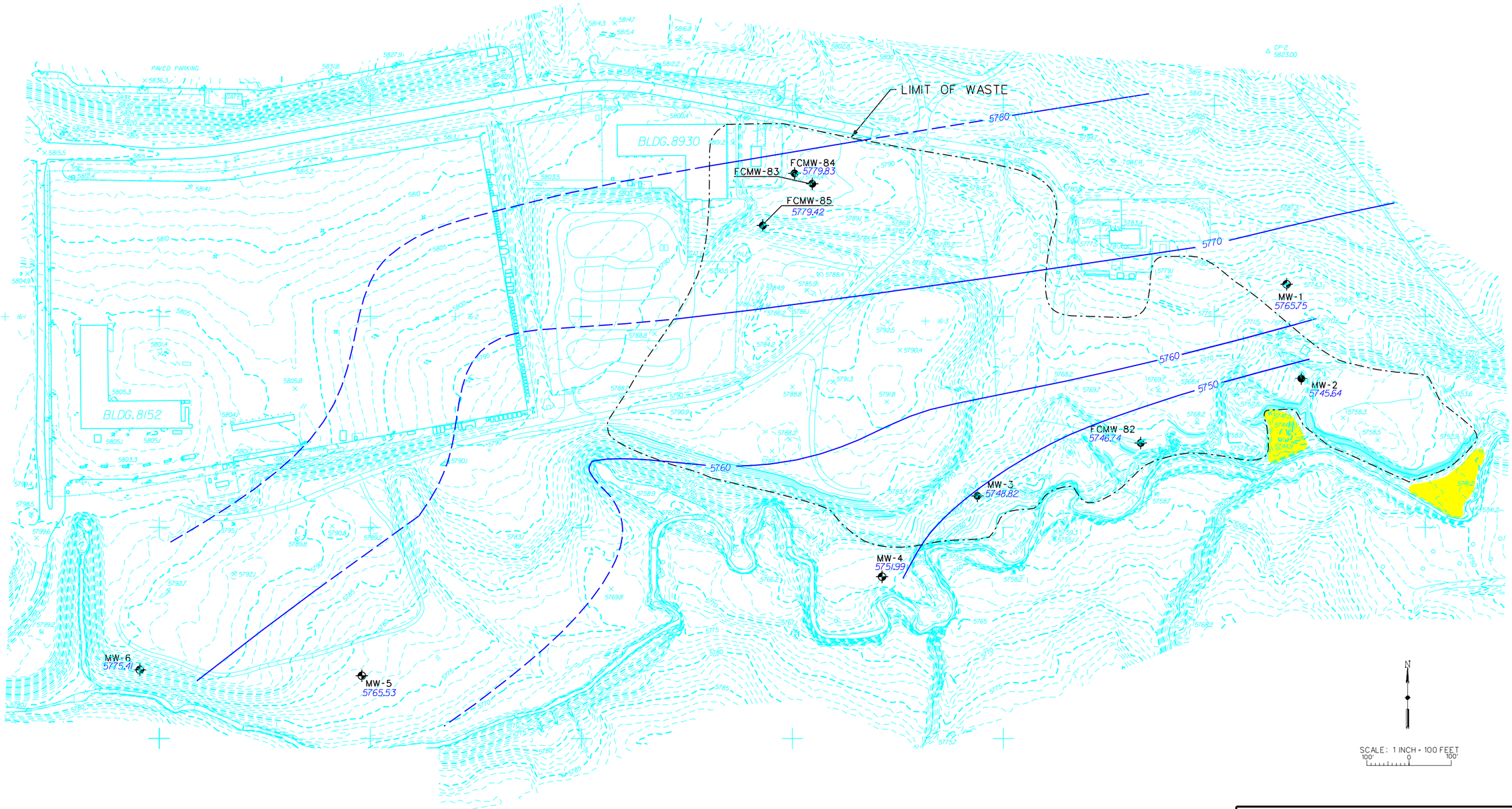
FORT CARSON FIGURE D2-5 COLORADO

ANALYTES ABOVE DRINKING WATER STANDARDS

LANDFILL No.5 (FTC-009)

Plot Scale Ratio: AS SHOWN
Date: 11/95
Design File: LF5BW.DGN
Spec. No.:
Drawing Code:
Contract No.: DACW 45
Sheet reference number: .

COMPUTER AIDED DESIGN & DRAFTING



NOTES:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

LEGEND

MW-5 5765.53	LOCATION OF EXISTING MONITORING WELL WITH ASSOCIATED WATER LEVEL ELEVATION
MW-3	LOCATION OF ABANDONED MONITORING WELL
	LIMITS OF LANDFILL MATERIALS
5760	WATER TABLE ELEVATION
TOPOGRAPHY	CONTOUR INTERVAL IS 1 FOOT

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MF
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

FORT CARSON COLORADO

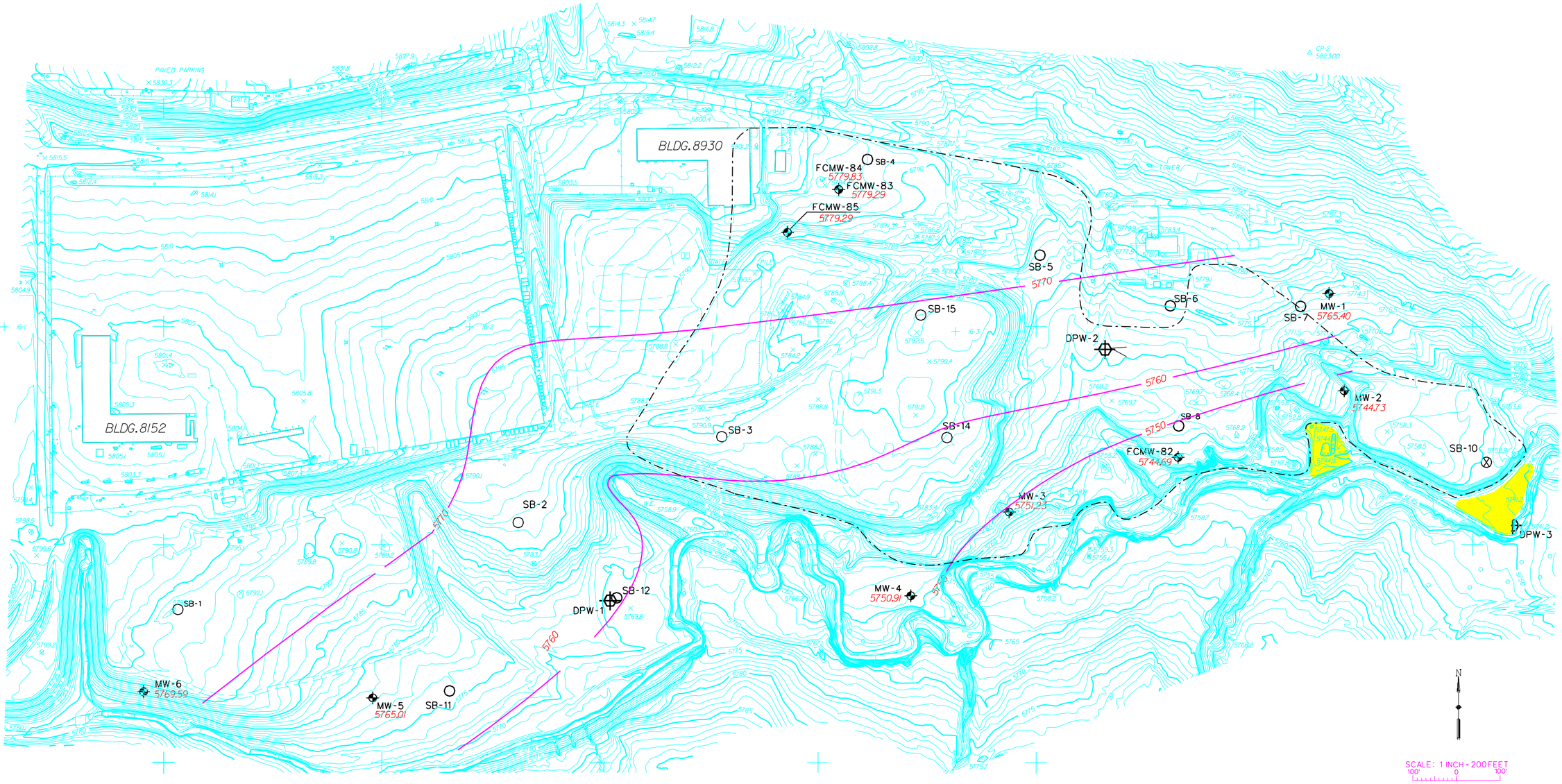
FIGURE D2-6

WATER TABLE ELEVATION
4/24/95

LANDFILL No.5 (FTC-009)

Plot Scale Ratio: AS SHOWN
Date: 11/95
Design File: LF5WT495.DGN
Spec. No.: DACW 45
Drawing Code:
Contract No.: DACW 45
Sheet reference number:

COMPUTER AIDED DESIGN & DRAFTING



NOTES:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853
   ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
   CONTROL BY MONTGOMERY-PHILLIPS, INC.
   DATE OF PHOTOGRAPHY: DECEMBER 14, 1994
   PHOTO SCALE: 1:3960'

2. SOIL BORINGS SB-9 AND SB-13 WERE NOT PERFORMED DUE TO ACCESS DIFFICULTIES.

LEGEND

- LOCATION OF SHALLOW BORING
- FCMW-84 — LOCATION OF EXISTING MONITORING WELL
- DIRECT PUSH WATER SAMPLE LOCATION
- 5785 — WATER TABLE ELEVATION (DASHED WHERE INFERED)
- APPROXIMATE LIMIT OF WASTE
- CONTOUR INTERVAL IS 1 FOOT

COMPUTER AIDED DESIGN & DRAFTING

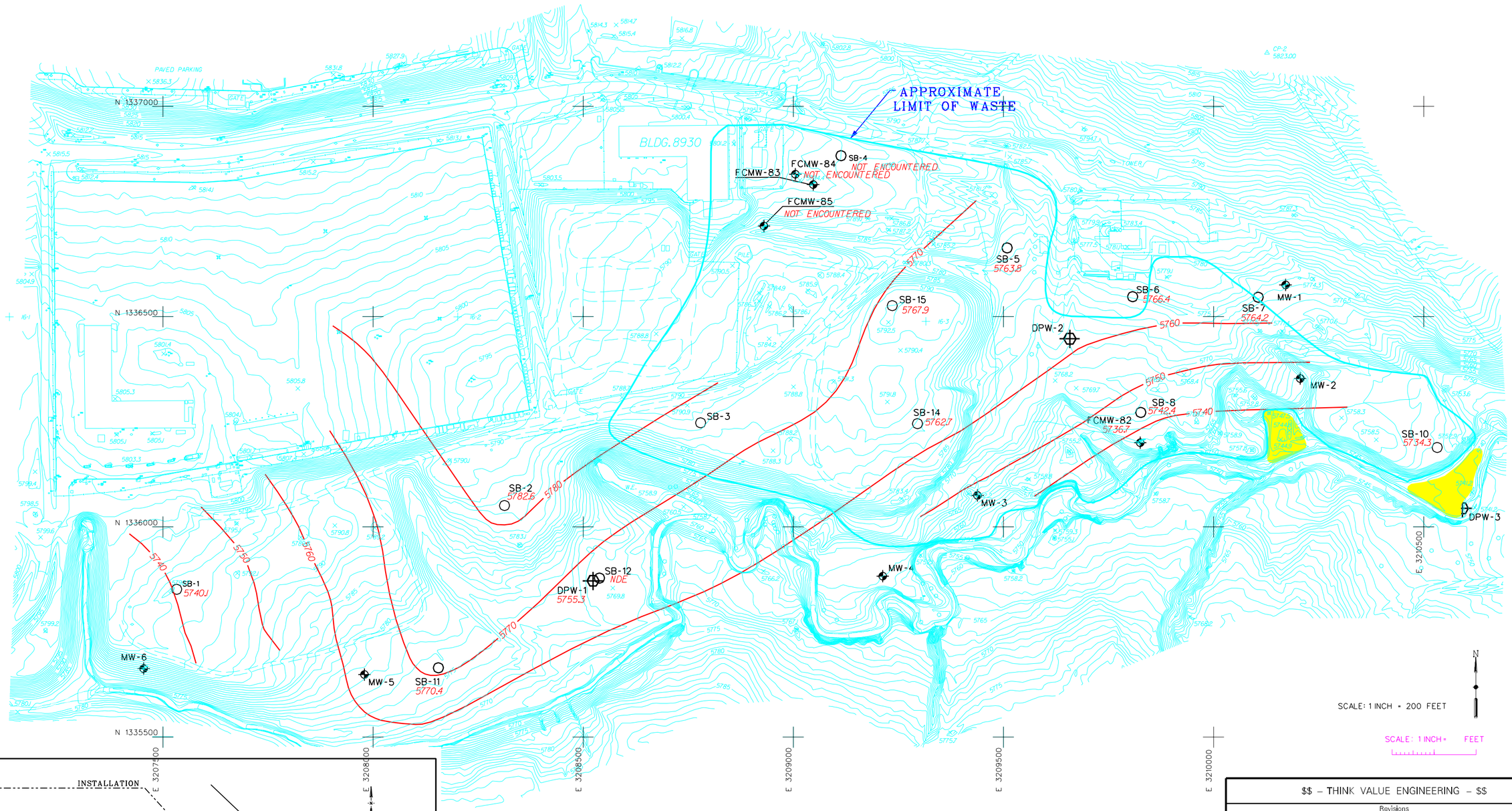
$$ – THINK VALUE ENGINEERING – $$

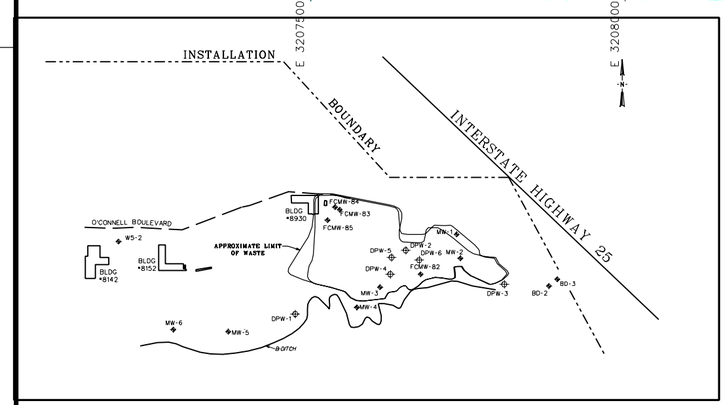
Revisions			
Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MW	FORT CARSON	COLORADO
Drawn by: AS	FIGURE D2-7	
Checked by: MY	**WATER TABLE ELEVATION 6/21/95**	
Reviewed by: JE	**LANDFILL No.5 (FTC-009)**	
Submitted by:	Plot Scale Ratio:	Date: 11/95
	Design File: LF5WR695.DGN	Sheet reference number:
	Spec. No.:	Drawing Code:
	Contract No.: DACW 45	





NOTE:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853
ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
CONTROL BY MONTGOMERY-PHILLIPS, INC.
DATE OF PHOTOGRAPHY: DECEMBER 14, 1994
PHOTO SCALE: 1:3960'

NOTES:

1. SOIL BORINGS SB-9 AND SB-13 WERE NOT PERFORMED DUE TO ACCESS DIFFICULTIES.

LEGEND

- LOCATION OF BORING
- FCMW-84 LOCATION OF EXISTING MONITORING WELL
- DIRECT PUSH WATER SAMPLE LOCATION
- 5785 TOP OF PIERRE SHALE CONTOUR INTERVAL IS 1 FOOT

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE MOUNTAIN DIVISION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: M.Y.
Drawn by:
Checked by:
Reviewed by:
Submitted by:

FORT CARSON COLORADO

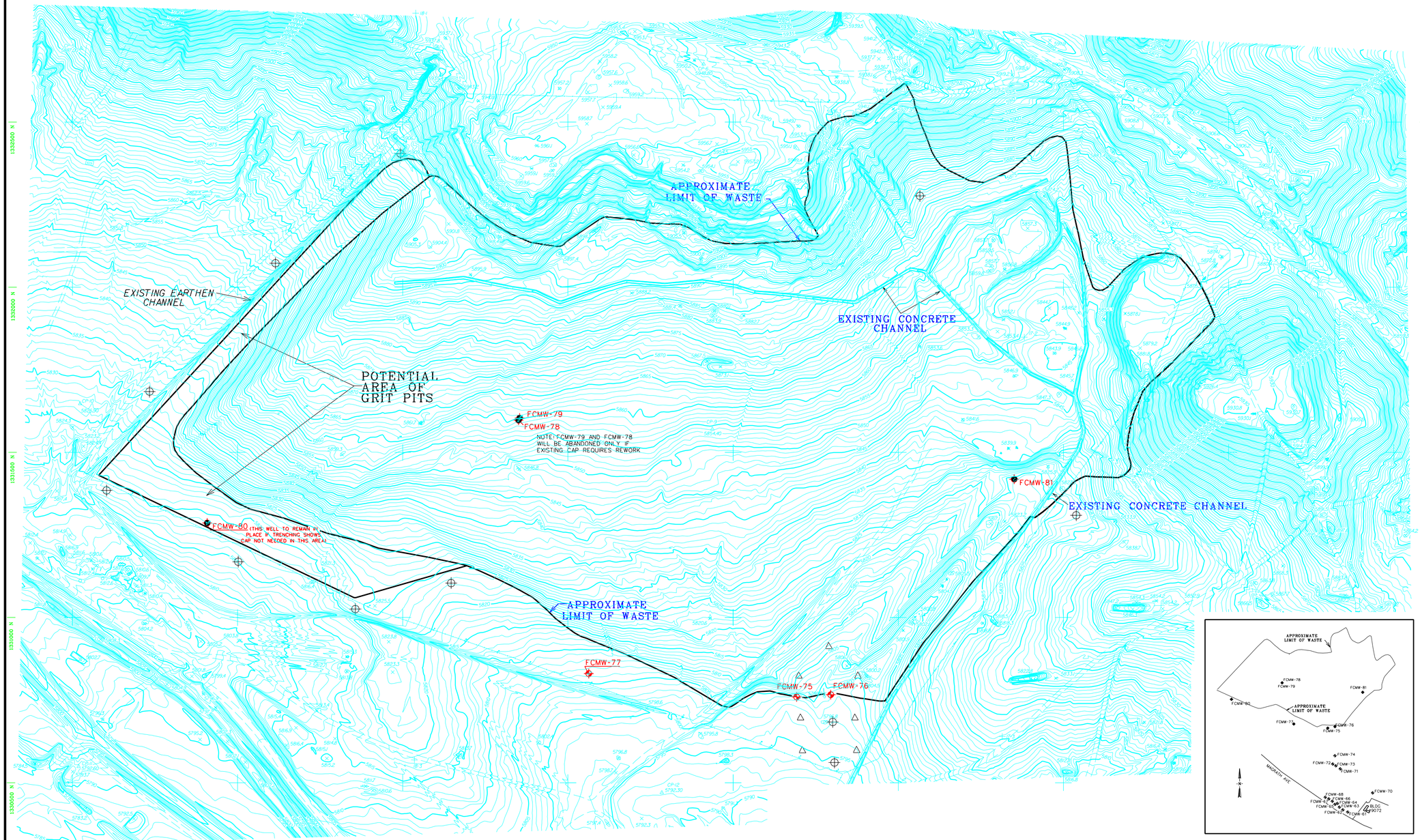
FIGURED D2-8

TOP OF PIERRE SHALE

LANDFILL No.5 (FTC-009)

Plot Scale Ratio:
Date:
Design File: LF5FIG5.DGN
Sheet reference number:
Spec. No.:
Drawing Code:
Contract No.: DACW 45

COMPUTER AIDED DESIGN & DRAFTING



N

LEGEND

FCMW-77 — LOCATION OF EXISTING MONITORING WELL

FCMW-78 — LOCATION OF MONITROING WELL TO BE ABANDONED PRIOR TO CAP INSTALLATION

LIMIT OF WASTE

SURVEY CONTROL POINT

APPROXIMATE LOCATION OF MONITORING WELL TO BE INSTALLED AFTER CAP INSTALLATION (LOCATION OF WELLS NEAR FCMW-76 WILL BE BASED ON DIRECT PUSH SAMPLES)

APPROXIMATE LOCATION OF DIRECT PUSH GROUND WATER SAMPLES TO BE COLLECTED PRIOR TO CAP INSTALLATION

HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.0002583
ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88
CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

SCALE: 1 INCH = 200 FEET
100' 0 100'

$$-THINK VALUE ENGINEERING-$$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE
DENVER ENVIRONMENTAL DIVISION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

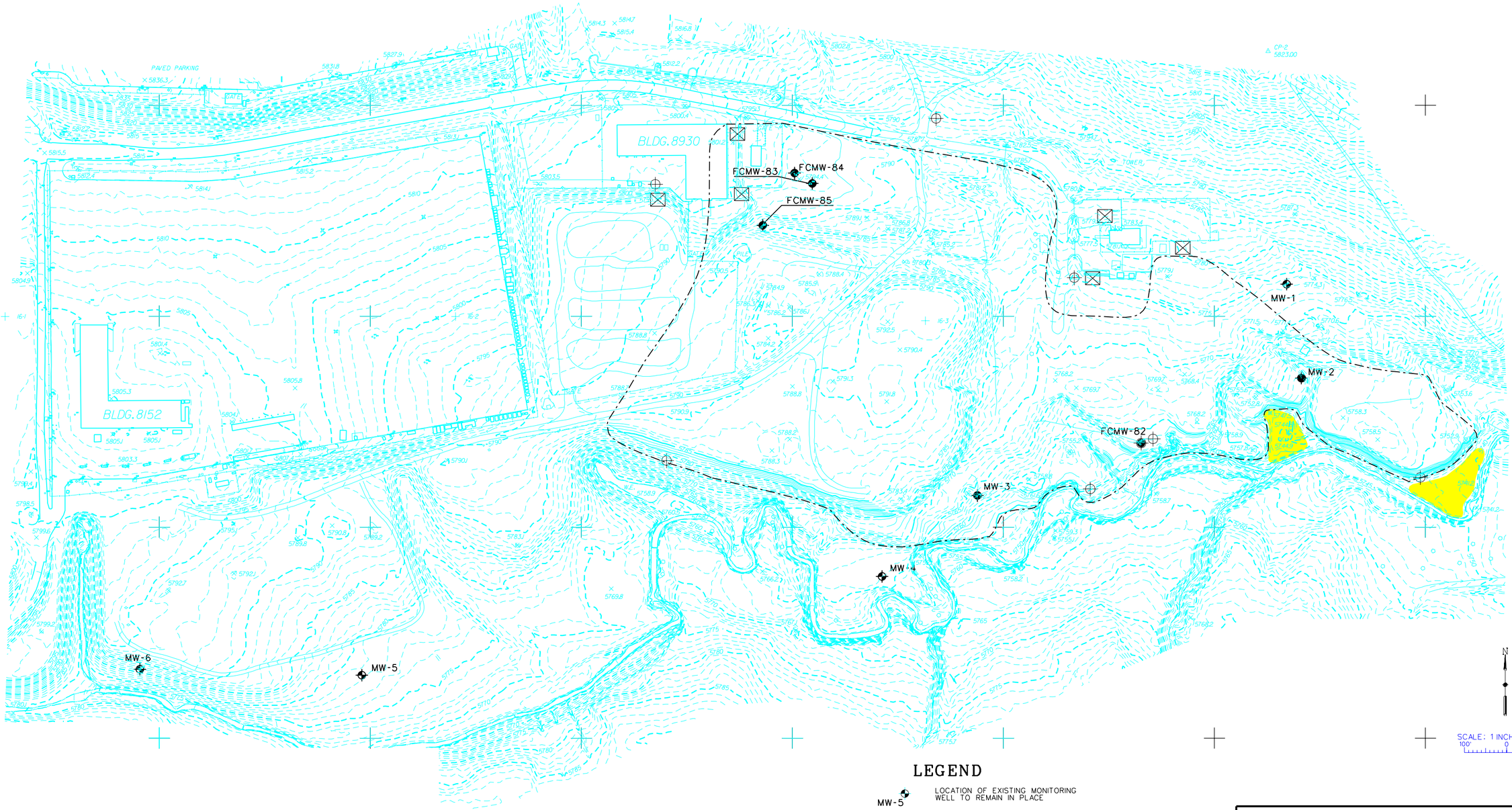
Designed by: M.W.
Drawn by: A.S.
Checked by: M.Y.
Reviewed by: J.E.
Submitted by: Chief: Section

FORT CARSON — FIGURE D5-1 — COLORADO

MONITORING WELL ABANDONMENT AND INSTALLATION PLAN

LANDFILL No.2 (FTC-006)

Plot Scale Ratio:
Design File: LF2MWABD.DGN
Date: 11/95
Spec.No.:
Drawing Code: F 421-90-02
Contract No.: DACW 45-93-D-0007
Sheet reference number:



LEGEND

MW-5 — LOCATION OF EXISTING MONITORING WELL TO REMAIN IN PLACE

APPROXIMATE LOCATION OF MONITORING WELL TO BE INSTALLED AFTER CAP INSTALLATION (LOCATION OF WELLS NEAR FCMW-82 WILL BE BASED ON DIRECT PUSH SAMPLES)

LOCATION OF ABANDONED MONITORING WELL

APPROXIMATE LOCATION OF SOIL GAS MONITORING PROBES TO BE INSTALLED PRIOR TO CAP INSTALLATION

CONTOUR INTERVAL IS 1 FOOT

N

SCALE: 1 INCH = 100 FEET
100' 0 100'

NOTES:

1. HORIZONTAL COORDINATES ARE MODIFIED STATE PLANE COORDINATES COLORADO CENTRAL ZONE BASED ON NAD83 WITH A DATUM ADJUSTMENT FACTOR OF 1.00026853 ELEVATIONS SHOWN ARE MEAN SEA LEVEL NAVD88 CONTROL BY MONTGOMERY-PHILLIPS, INC.

DATE OF PHOTOGRAPHY: DECEMBER 14, 1994

PHOTO SCALE: 1:3600'

$$ – THINK VALUE ENGINEERING – $$

Revisions

Symbol	Descriptions	Date	Approved

RUST ENVIRONMENT & INFRASTRUCTURE
MOUNTAIN DIVISION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

Designed by: MF
Drawn by: AS
Checked by: MY
Reviewed by: JE
Submitted by:

FORT CARSON COLORADO

FIGURE D5-2
MONITORING WELL ABANDONMENT AND INSTALLATION PLAN
LANDFILL No.5 (FTC-009)

Plot Scale Ratio: AS SHOWN
Date: 11/95
Design File: LF5ABMW.DGN
Spec. No.: DACW 45
Drawing Code:
Contract No.: DACW 45
Sheet reference number:

COMPUTER ADDED DESIGN & DRAFTING

APPENDIX E

DRAFT CONSTRUCTION QUALITY ASSURANCE PLAN

DRAFT
CONSTRUCTION QUALITY ASSURANCE PLAN
LANDFILLS 2, 5, AND 6
CAP INSTALLATION PROJECT
FORT CARSON, COLORADO

Prepared for:
U.S. Army Corps of Engineers
Omaha District

Prepared by:
Rust Environment & Infrastructure
Englewood, Colorado

Project No. 89868.300

November 1995

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Section **Page**

FIGURES

ATTACHMENTS

LIST OF ACRONYMS

ANSI	American National Standards Institute
ASTM	American Standard Testing Methods
CM	Construction Manager
CQA	Construction Quality Assurance
CQC	construction quality control
DECAM	Design/Construction Team
FIO	For Information Only
GA	Government Approval
NIOSH	National Institution of Occupation Safety and Health
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
QA	Quality assurance
QAL	Quality Assurance Laboratory
QC	Quality control
Rust	Rust Environment & Infrastructure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TERC	Total Environmental Restoration Contract
USACE	U.S. Army Corps of Engineers

E1.0 PURPOSE AND SCOPE OF CONSTRUCTION QUALITY ASSURANCE PLAN

This Construction Quality Assurance (CQA) Plan has been prepared by Rust Environment & Infrastructure (Rust, the Contractor) for the U.S. Army Corps of Engineers (USACE), Omaha, Nebraska to guide quality assurance (QA)/quality control (QC) tasks during the Landfills 2, 5, and 6 Cap Installation Project at Fort Carson, Colorado. This CQA Plan will be implemented to ensure (1) construction activities are performed in a manner consistent with the intent of the approved design drawings and specifications, (2) the construction performance criteria are achieved, and (3) the quality of the constructed project is maintained.

E1.1 PURPOSE

The purpose of the CQA Plan is to establish the general quality objectives to be accomplished during the Landfills 2, 5, and 6 Cap Installation Project. These quality objectives include those specified by the USACE, specific delivery order or task requirements, applicable industry standards and codes, and Rust corporate and professional standards. The CQA Plan will provide general controls, supervision, inspections, and tests to achieve the specified quality during construction activities.

E1.2 SCOPE OF THE CONSTRUCTION QUALITY ASSURANCE PLAN

The CQA Plan serves as the QA/QC document for all work to be accomplished during the Landfills 2, 5, and 6 Cap Installation Project under the Total Environmental Restoration Contract (TERC). It covers all activities to be accomplished both onsite and offsite by Rust and subcontractor personnel. In addition, it covers all materials and equipment used by the Rust team on the project.

The CQA Plan includes the following to cover all operations of the Rust team during the project:

- QA/QC organization and authorities;
- Meetings and methods for communication;
- Contractors performance;
- Tracking of deficiencies and corrections;
- Inspections of definable work activities;
- Reporting procedures and documentation; and
- Plan acceptance and modifications.

E1.3 CONSTRUCTION QUALITY ASSURANCE PLAN ORGANIZATION

This CQA Plan addresses QA/QC activities during construction of the caps for Landfills 2, 5, and 6. The sections that follow this Introduction are Project Team Organization, Authority, and Responsibilities (Section 2.0), Project Communications (Section 3.0), Subcontractor Performance (Section 4.0), Quality Control (Section 5.0), Quality Assurance (Section 6.0), Acceptance and Modification of CQA Plan (Section 7.0), Security, Employee Indoctrination, and Permits (Section 8.0), Glossary (Section 9.0), and References (Section 10.0).

The Project Team organization chart is included as Figure E-1 Attachment 1 contains QC and QA forms, and Attachment 2 contains a list of anticipated tests. Submittal register forms will be included with the USACE technical specifications.

E2.0 PROJECT TEAM ORGANIZATION, AUTHORITY, AND RESPONSIBILITIES

This section sets forth the roles of the parties involved in the Landfill Capping and their responsibilities with regard to construction QA/QC. The primary participants involved in the Landfill Capping include the Design/Construction Team (DECAM), the USACE, subcontractors, and equipment vendors.

E2.1 PROJECT TEAM AND QUALITY ASSURANCE/QUALITY CONTROL ORGANIZATION

Figure E-1 depicts the proposed project team and QA/QC organization for the project. The positions described on the organization chart are described in the following subsections.

E2.1.1 Owner and Owner's Engineer

DECAM is responsible for managing the entire cleanup effort at Fort Carson. Mr. Jim Henderson will represent the interests of DECAM during the project. The USACE has agreed to manage the Landfills 2, 5, and 6 Capping Project. The USACE has appointed Ms. Linda White as Project Manager to represent them during the project. The USACE is responsible for ensuring that the Landfills 2, 5, and 6 Cap Installation Project is completed in accordance with the applicable regulatory requirements. The USACE has the authority to accept or reject design drawings and specifications, support plans, planning documents, reports and recommendations of the Design/Construction Team, and materials and workmanship of any subcontractors.

E2.1.2 Design/Construction Team

The USACE has designated Rust as the design/construction firm for this project. Rust has prepared the design drawings and specifications and will provide project management, construction management, and engineering support during the Landfills 2, 5, and 6 Cap Installation Project. Rust will report to the USACE's Project Manager on matters concerning the performance and acceptability of construction work performed onsite. In addition, Rust will provide the necessary office engineering and field staff required to evaluate whether construction quality objectives are met.

E2.1.2.1 Design/Construction Project Manager and Engineering Task Manager

Rust has designated Mr. John England as a Project Manager. He will have overall responsibility for verifying that all project participants properly implement the Landfill Capping procedure by enforcing the requirements described in this CQA Plan. Mr. England will maintain an awareness of construction QA/QC issues through communication with the Fort Carson's Project Manager, the USACE, and the CQA Manager.

Mr. England, or his designee, will serve as the primary point of contact for all issues involving the USACE or the Fort Carson project, and will be responsible for overall management and coordination of project-related engineering and construction activities, and execution of the CQA program.

Rust will also appoint an Engineering Task Manager for the engineering and design of modification components. The Engineering Task Manager will serve as the primary point of contact for all design-related issues involving the drawings and specifications, and will be responsible for managing and coordinating project-related engineering activities.

E2.1.2.2 Construction Quality Assurance Manager

The CQA Plan will be implemented by the independent CQA Manager, which will be onsite for the duration of construction activities. The CQA Manager is responsible for ensuring QC measures have been implemented by the subcontractor in accordance with drawings and specifications.

The CQA Manager will be onsite to ensure that the CQA Plan is properly implemented and that construction quality control (CQC) objectives are attained. CQC objectives are discussed in Section 5.0, Quality Control. The CQA Manager will maintain frequent communication with the Project Manager. The CQA Manager will have the authority to report directly to the USACE if CQA Plan deviations are not adequately addressed and corrected.

The CQA Manager or his designee, under the direction of the Project Manager, will be authorized to fulfill the following specified responsibilities:

- Reviewing design drawings and specifications for accuracy and completeness so that the CQA Plan can be implemented;

- Educating CQA personnel on CQA requirements and procedures pertaining to construction activities;
- Preparing a schedule of CQA inspection and observation activities and coordinating necessary CQA personnel to conduct inspections and observations;
- Reviewing and interpreting data and reports prepared by CQA inspection personnel;
- Identifying to the USACE work that will be either accepted or rejected on the basis of observations or test results. The CQA Manager may require special testing, inspection, or approval in areas of questionable quality or deviations from design specifications;
- Becoming familiar with the overall work schedule and sequence of work;
- Preparing a final report documenting the construction activities and test results; and
- Acknowledging that the final project is within substantial compliance in accordance with the approved drawings and specifications.

E2.1.2.3 Administrative Support

The Project Manager, or his designee, will be responsible for providing filing, engineering, word processing, and graphics support personnel offsite during the Landfills 2, 5, and 6 Cap Installation Project. Administrative support personnel will, at a minimum, be responsible for document filing, preparation of correspondence, copying, and slide preparation. The Project Manager will also provide personnel experienced in cost tacking, schedule modification, and computer aided drafting as the project requires.

E2.1.2.4 Site Safety and Health Officer

The primary Site Safety and Health Officer (SSHO) for construction activities will report to the Project Manager. An alternate SSHO will also be designated. The SSHO has responsibility for implementing the site health and safety requirements for construction activities and has responsibility for checking that project participants are aware of and comply with the requirements of the Contractor's Site Safety and Health Plan (SSHP).

The SSHO will conduct tailgate health and safety meetings and perform inspections of work site activities. The SSHO has the authority to shut down operations that pose a potential threat to site personnel.

E2.1.2.5 Construction Manager

It is the responsibility of the Construction Manager (CM) to manage the construction of the Landfills 2, 5, and 6 Cap Installation Project. This responsibility includes the following QC components:

- Monitoring quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of quality specified in individual specification sections;
- Complying fully with manufacturer's installation instructions;
- Should manufacturer's instructions or reference standards conflict with contract documents, requesting clarification from the Engineering Task Manager before proceeding;
- Complying with standards specified in individual specification sections as a minimum quality measure for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship;
- Performing work by persons qualified to produce work of quality specified in individual specification sections;
- Obtaining copies of standards when required by contract documents;
- When specified in individual specification sections, requiring material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary;
- Submitting qualifications of manufacturer's observer to the USACE 24 hours in advance of required observations; and
- Submitting copies of the report prepared by manufacturer's representative to the USACE for review.

E2.1.2.6 Quality Assurance Laboratory

The Quality Assurance Laboratory (QAL) is responsible for conducting tests on samples taken from the site. The QAL may or may not be affiliated with the contractor. The QAL shall be selected and approved by the USACE prior to the start of construction. The QAL is responsible for conducting the appropriate laboratory tests as directed by the contractor. The test procedures shall be done in accordance with the test methods outlined in this plan.

E3.0 PROJECT COMMUNICATIONS

Periodic meetings will be held throughout the construction of the Landfill Caps to enhance, as necessary, communication among the Contractor, the USACE, and their representatives. These meetings will help in maintaining familiarity with construction procedures, health and safety issues, construction activities, and recent design changes, if any. Meetings to be conducted during the project are as follows:

- Preconstruction meeting;
- QA/QC Meeting;
- Daily tailgate health and safety meetings;
- Weekly progress meetings; and
- Problem or work deficiency meetings (as needed).

The schedule, agenda, and attendants of these meetings are discussed in the following subsections.

E3.1 PRECONSTRUCTION INSPECTION AND MEETING

A preconstruction meeting will be scheduled a minimum of eight weeks prior to construction activities, and should be held at the site if feasible. All representatives from the USACE, DECAM, and the Contractor will be asked to attend. The purpose of the preconstruction meeting is to:

- Discuss any appropriate modifications, and develop a design addenda if necessary;
- Review the responsibilities of each party;
- Review lines of authority and communication;
- Review procedures for documentation and reporting of information;
- Review distribution and storage of documents and reports;
- Establish protocol for testing;
- Establish protocol for handling construction deficiencies, repairs and retesting;
- Conduct a site walk-around to discuss work plans and inspect material handling, borrow and stockpile locations;
- Review a time line schedule for all operations; and
- Discuss and establish procedure for material processing.

E3.2 PRECONSTRUCTION HEALTH AND SAFETY MEETINGS

Preconstruction health and safety meetings will be conducted at least weekly or (1) whenever risks or hazards change, (2) whenever new personnel arrive, and (3) when field operations warrant indoctrination and training. Safety meetings will be conducted by the designated SSHO and will be

attended by all site project personnel involved, as appropriate. Where procedural deficiencies are identified, additional safety meetings will be conducted to address the situation. The following will be addressed during the preconstruction health and safety meetings:

- Review of planned activities;
- Work area health and safety designations;
- Hazards suspected;
- Personal protective equipment (PPE) required;
- Communications;
- Field personnel responsibilities; and
- Emergency procedures.

E3.3 WEEKLY PROGRESS MEETINGS

Weekly progress meetings will be held to (1) review and discuss the previous week's activities and progress, (2) discuss current and future work, (3) discuss any current or potential construction problems that may affect the user, (4) discuss outstanding action items and resolutions, and (5) discuss new action items. The Contractor will schedule and conduct the weekly progress meetings and will transmit the meeting minutes to all parties attending the meeting. The Engineering Task Manager, the CQA Manager, and representative from each subcontractor will be invited to attend, as necessary. The USACE and DECAM, or their representatives, may also attend to discuss and evaluate progress.

E3.4 PROBLEM OR WORK DEFICIENCY MEETINGS

Special meetings may be held when a problem or deficiency occurs or is identified. Personnel will not wait until weekly progress meetings to address problems or deficiencies. Special work deficiency meetings may be attended by the Project Manager, CM, the CQA Manager, subcontractors, and/or other involved parties, as necessary. The purpose of these meetings will be to identify problems or deficiencies in the construction work, review alternative solutions, and select and implement corrective measures to resolve the problems or deficiencies.

E4.0 VENDOR AND SUBCONTRACTOR PERFORMANCE

The performance of the vendors and subcontractors will be assessed by the CQA Manager to check that the performance standards of the Landfills 2, 5, and 6 Cap Installation Project are accomplished. The assessment criteria include adherence to the approved technical specifications and drawings, achieving the construction schedule, adequately maintaining construction coordination and work sequencing, maintaining close communication with the USACE and Project Manager, and proper site administration.

E4.1 CONFORMANCE WITH SPECIFICATIONS AND DRAWINGS

All work performed by the Contractor and any subcontractors shall be consistent with the requirements presented in the USACE technical specifications and drawings. The Contractor will check the subcontractors' work compared to the approved construction drawings and specifications. As work progresses, clarification of details, dimensions, and intent of design are common and expected. When clarifications are required, the Engineering Task Manager will be responsible for providing these clarifications. A record of the clarification response shall be recorded in the Contractor's daily report. If required, written clarifications, such as field orders, memorandums, sketches, and revised specifications and drawings will be issued. Written clarifications from the Engineering Task Manager that will alter the intent of the construction drawings and specifications will not be issued without written approval from the USACE. The Contractor will determine if a change order is required as part of the clarification response. Change orders that increase or decrease the cost of performing the work will be approved by the USACE's Project Manager.

E4.2 CONSTRUCTION SCHEDULE

As required by the technical specifications, the Contractor will be required to submit a construction schedule for their portion of the work and update it monthly. Each schedule will be reviewed by the Project Manager and the CQA Manager. Deviations from the construction schedule will be clearly identified by the Contractor. Revisions to the construction schedule will be made by the Contractor and approved by the USACE as required.

E4.3 CONSTRUCTION COORDINATION AND WORK SCHEDULING

The Contractor shall plan, schedule, and coordinate his and any subcontractor's operations in a manner that will facilitate the simultaneous progress of the work. Construction sequencing will address logistical and technical considerations as required to ensure the successful completion of field activities in accordance with the approved construction schedule.

E4.4 NOTICES TO USACE

The Contractor will notify the USACE of the commencement and completion of milestone activities as identified in the construction schedule. In addition, the Contractor will notify other contractors performing work at Fort Carson when performance of the work may affect them.

E4.5 SITE ADMINISTRATION

The Contractor will be responsible for all areas of the Site used by the Contractor and any subcontractors in performance of the work and adjacent offsite areas where work is required. The Contractor will control the actions of all employees and other persons with respect to (1) health and safety, and (2) the use and preservation of property and existing facilities, except such controls as may be specifically reserved to the USACE, Engineer, or others. The USACE and the Contractor have the right to exclude from the Site all persons who have no purpose related to the work or its inspection, or who do not abide by Site health and safety requirements.

E5.0 QUALITY CONTROL

CQC activities consist of performing field inspections with field and laboratory testing to check that the CQC objectives identified in the drawings and specifications are achieved. The Contractor will perform quality control procedures as required in the construction specifications and drawings.

E5.1 QUALITY CONTROL OBJECTIVES

The primary QC objective for all work performed during construction at the Site is to satisfy all mandatory requirements set forth by the approved Landfills 2, 5, and 6 Cap Installation Project and included in the approved specifications and drawings. Specific QC objectives for construction of the landfills include, but are not limited to, the following:

- Setting specific standards and procedures for construction performance through the specifications and drawings.
- Performing the work in compliance with those standards and procedures so that construction meets or exceeds the desired performance.
- Measuring variances from the standards specified and taking action to correct unacceptable variances.
- Documenting the results of CQC procedures and activities to allow independent review and verification that the quality control objectives are being achieved.

E5.2 QUALITY CONTROL PROCEDURES FOR DOCUMENTS, SUBMITTALS, AND MATERIALS

The Contractor will perform field inspections as required by the construction specifications and drawings, and any codes and standards that the construction specifications and drawings invoke. Specific procedures for these inspections are described in the construction specifications or by published testing protocols cited in the construction specifications. The Contractor will coordinate inspection activities with the USACE and the CQA Manager, as necessary.

Testing, reporting, inspecting and modification activities will be documented, and records will be kept of these activities. These documents will also follow control submittal procedures to ensure all

responsible entities remain informed. This section describes the general requirements for document, submittal, and material QC procedures.

E5.2.1 Responsibilities

The Contractor is responsible for ensuring the proper control of documents and submittals in the execution of the delivery order activities. The Contractor has sign-off authority and is responsible for filling out the Daily Quality Control Report (Attachment 1).

E5.2.2 Basic Requirements

The CM will establish and maintain procedures for identifying, preparing, reviewing, approving, revising, collecting, indexing, filing, storing, maintaining, retrieving, distributing, and disposing of pertinent quality documentation and records. Such procedures will be applicable to all forms of documents and records, including print and electronic media.

Documents requiring quality control will be identified in the specifications. Documents, including revisions, will be reviewed by the CM for conformance with technical requirements and quality system requirements and forwarded to the Project Manager for release. Documents used to perform work (e.g., technical manuals and operating procedures) will be identified and kept current for use by personnel performing the work. Measures will be taken to ensure that users understand the documents to be used. Obsolete or superseded documents will be identified and removed from service.

Sufficient records will be specified, prepared, reviewed, authenticated, and maintained by the CM to reflect the achievement of the required quality for completed work and/or to fulfill any statutory requirements. The maintenance of records will include provisions for retention, protection, preservation, traceability, and retrievableness. Where evidentiary records are involved, the maintenance of records will also include establishing and implementing appropriate chain-of-custody and confidentiality procedures for the affected records. Retention times for records will be determined based on contractual and statutory requirements, or, if none stated, as specified by the CQA Manager. While in storage, records will be protected from damage, loss, and deterioration.

E5.2.3 Submittals

QC procedures for certifying and approving submittals for any phase of the construction will be instituted as part of this CQA Plan The QC activities will cover all submittals from the Contractor as well as submittals for subcontractors, suppliers, or offsite fabricators. The submittals may include reports, drawings, shop drawings, and material, equipment and testing plans. Specific procedures for tracking submittals will be determined in the pre-construction meeting. At a minimum, the CQA officer will review each submittal to assure conformance with contract requirements. Following review, the submittal package will be sent to the Engineering Task Manager and then to the USACE for review. Scheduling and review of submittals will be coordinated between the CM, the CQA Manager, and the Engineering Task Manager.

The general preliminary procedure for submittals will be as follows:

- Submittal Register: The Submittal Register will be prepared by the Rust Design/Construction Team with assistance from the USACE. Engineering Form 4288 will be utilized for this task.

- Category I (GA1) Submittals:

  - Category I submittals are noted as "Government Approval (GA)1" submittals.

  - The CM will prepare three (3) copies of these submittals and submit to the CQA Manager.

  - The CQA Manager or CQA personnel will review and certify that the submittal package meets the contract requirements. The CQA Manager will retain one (1) copy for the CQA files and submit two (2) copies to the Engineering Task Manager for review.

  - The Engineering Task Manager will review each submittal package, retain one (1) copy, and will forward one (1) copy to USACE Project Engineer for the USACE project files.

  - The USACE Project Engineer will notify the Rust Project Trailer of submittal receipt to expedite either construction or resubmittals.

  - Shop Drawings will be received directly by the Engineering Task Manager who will review and approve. Once approved, one copy of the drawing will be sent to the Vendor, one copy will be retained, one copy will be sent to the USACE for project files, and one copy will be sent to the CQA Manager.

- Category II (GA2 or FIO) Submittals:

  - Category II submittals are noted as "GA2" or "For Information Only (FI)O" submittals.

  - Following receipt of each submittal package, the CQA Manager will review three (3) copies of these submittals and certify that the submittal meets the contract requirements. Following the CQA review, two (2) of the submittals will be forwarded to the Engineering Task Manager. The CQA Manager will retail one copy for CQA files.

  - The Engineering Task Manager will retain one (1) copy and deliver one (1) copy to the USACE for the USACE project file.

  - The USACE will notify the Rust project trailer of submittal receipt to expedite construction or resubmittals.

- Submittal Transmittal Form: A completed Engineering Form 4025 will accompany each submittal package.

Examples of the submittal register forms and submittal transmittal forms will be included in the USACE specifications with the 90 percent design submittal.

E5.2.4 Request for Information/Clarification

If the subcontractor requires additional information or clarification, a Request for Information/Clarification form (Attachment 1) will be submitted to the Engineering Task Manager. A Request for Information/Clarification log will be used by the Contractor to track information requests and copies will be submitted to the CQA team.

E5.2.5 Statement of Compliance

Rust will submit a Statement of Compliance to the USACE representative at the end of each pay period. This Statement of Compliance will assure compliance with United States labor laws by Rust and subcontractors.

E5.2.6 Change Order

A Change Order will be submitted to the USACE representative via serial letter when a change to the contract is anticipated. Rust will log the request and track the response.

E5.2.7 Serial Letters

Serial letters are to be used as correspondence between the Contractor and USACE. Rust will log all serial letters for both the Contractor and USACE.

E5.2.8 Procurement of Materials and Services

The procurement of purchased items and services that directly affect the quality of the landfill capping will be controlled to ensure that the quality of the items and services is known, documented, and meets the technical requirements and acceptance criteria of USACE.

It is the policy of Rust to maintain full accountability for all property acquired under a federally funded contract. Actions related to the receipt, inspection and control of materials after delivery to construction sites will be in accordance with the project Government Property Control System Procedure Manual. See Attachment 1 for forms that will be used to track any government property purchased as part of this contract.

Procurement documents (i.e. purchase orders, services agreements, etc) will contain information clearly describing the item or service needed and the associated technical and quality requirements. The procurement documents will specify the QC elements for which the supplier is responsible and how the supplier's conformance to the USACE requirements will be verified. Procurement documents will be reviewed for accuracy and completeness by Rust. Changes to procurement documents will receive the same level of review and approval as the original documents.

Appropriate measures are established and described in the control phases work flow paths to ensure that the procured items and services satisfy all stated requirements and specifications. Each supplier will have a demonstrated capability to furnish items and services that meet all requirements specified in the procurement documents.

E5.2.9 Document Access and Control

All controlled documentation will be clearly marked with the delivery order number and unique Rust project number. Documents that may require controls include:

- Blueprints;
- Design documents, including specifications, drawings, calculations, and data sheets;
- Work instructions, procedures, and operating guides;
- Meeting minutes;
- Calculations (including those from data reduction and analysis);
- Calibration data;
- Field logbooks;
- Inspection results;
- Telephone logs;
- Memoranda;
- Instrument test data;
- Materials testing results;
- Personnel qualifications;
- Sampling and analytical QC data (including objective and statutory evidence);
- Sampling and analytical data; and
- Technical and readiness reviews results.

Documents will be filed and stored following Rust standard filing procedures.

E5.3 TESTS

Tests will be performed as required by the specifications and USACE requirements to verify that QC measures are sufficient to complete project activities and comply with delivery order and contract requirements. A list of anticipated tests are included in Attachment 2.

E5.3.1 Testing Responsibilities

Rust has the responsibility to ensure that the QC inspections and tests of equipment and instrumentation used to conduct project work are performed in accordance with the specifications. Rust is also responsible for ensuring the maintenance and calibration of measuring and test equipment. See Attachment 1 for the appropriate record forms.

E5.3.2 Testing Procedures

A list of the tests to be performed during each phase of construction is included as Attachment 2. Test name, frequency, and the test standard or protocol to be followed are specified.

Rust will perform the following activities:

- Verify that testing procedures comply with contract, delivery order, and USACE requirements;
- Verify that facilities and testing equipment are available and comply with testing standards;
- Verify that checks have been conducted of test instrument calibration data against certified standards;
- Verify that recording forms and test identification control numbering systems, including all of the test documentation requirements, have been prepared; and
- Record results of all tests taken, both passing and failing tests, on the daily QC report. This report will include:
  - location where tests were taken;
  - the sequential control number identifying the test;
  - information on retests of failed tests and remedial action taken to correct failures; and
  - other pertinent information.

Reports of tests performed by the Contractor will be attached to the Daily QC Report and the results submitted at a later date with reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility will be provided directly to the USACE.

E5.3.3 Testing Methods and Standards

All applicable testing will follow recognized and accepted testing methods and standards. These methods and standards are included and defined in Attachment 2. While not all inclusive, the following types of testing methods and standards will be followed by Rust:

- National Institution of Occupational Safety and Health (NIOSH);
- Military Standards/Specifications;
- Occupational Safety and Health Administration (OSHA);
- American National Standards Institute (ANSI); and
- American Standard Testing Methods (ASTM).

E5.3.4 Monitoring and Testing Equipment

Rust and its subcontractors will use all required monitoring and testing equipment in accordance with manufacturers' specifications and operating procedures. Only properly trained personnel will operate the equipment. No deviation from the established operating procedures will be permitted by field personnel. Rust will monitor and document performance on a daily basis in a field log book and into

the QC Daily Report. Any deficiencies of equipment will be reported to Rust by equipment operators. Any deviation in procedures by personnel will be documented and appropriate action taken to prevent future practice.

Monitoring and testing equipment will be calibrated following manufacturers' requirements. All field calibrations will be conducted by equipment operators and confirmed by Rust. These field calibrations will be documented on the appropriate record form by Rust. Any equipment requiring manufacturer's calibration and/or equipment failing to meet field calibration checks will be removed from service. All manufacturers' calibration sheets, repair logs, etc. will be submitted to Rust, attached to the Daily QC Report, and permanent records will be kept. No piece of monitoring or testing equipment will be used in the field if it fails to meet field calibration checks or has an expired manufacturer's calibration date.

E5.3.5 Test Results

The CM will receive all test results from any testing conducted on a delivery order. The CM will review all results and coordinate the development of necessary documents to report results to the CQA Manager, the Engineering Task Manager, and the USACE. Test results will be included with the Daily QC Report. The CM will ensure that results and reports are distributed and proper records are kept at the project site.

E5.3.6 Testing Laboratories

Testing laboratories will be USACE certified or otherwise approved.

E5.3.7 General Procedures for Control, Verification, and Acceptance Testing

Rust will develop procedures applicable to each phase of construction to provide control, verification, and acceptance testing as part of the QC activities. These procedures will be established by the CQA Team and the USACE and implemented at the appropriate level. Rust is responsible for maintaining project-specific quality records including:

- Documentation of inspections and tests;
- Audit results;

- Quality control logs; and
- Project-specific quality training and retraining.

These procedures will be included in addenda to the CQA Plan. Rust will work closely with the USACE Project Manager and his staff in developing these procedures.

E5.3.8 Procedures for Tracking Control, Verification, and Acceptance Test Results

Rust has developed the following procedures for tracking the work flow through the various construction phases as well as verification and acceptance testing. The CM will maintain records of all quality control operations, activities, and tests performed for all activities including any of those for suppliers and subcontractors. These records will be maintained as part of the project history file and will describe the personnel involved, the weather conditions encountered, if applicable, any delays, nonconforming materials or equipment encountered, and acknowledgment of deficiencies noted, including the corrective actions taken to prevent reoccurrence. Records shall include the completed QC inspection/test procedures to show evidence that required activities or tests have been satisfactorily performed. Records of quality control activities include, but are not limited to, the following:

- Procedures used for quality control inspections/tests;
- Procedures used for quality control of any engineering analyses activities;
- The results of inspections or tests or quality control reviews with authorized signature;
- Nature and extent of the defects and causes of rejection including corrective actions taken; and
- Results of the quality control audits.

E5.4 QC REQUIREMENTS FOR DEFINABLE ACTIVITIES

Definable inspection activities are described in this section according to (1) the general construction item, and (2) the phase of modification in which observations and tests that are necessary to ensure that the modifications meet or exceed the specified design requirements will occur. Organizations involved in construction activities, including the USACE and the Contractor, will familiarize themselves with these planned CQC/CQA activities.

The CQA Manager will conduct preconstruction training and information sessions with the site CM and CQA personnel to familiarize them with the specified design, inspection policies, and procedures. "Construction Phase" is a general term that refers to all of the activities required to complete the Landfill Caps. Section 5.4.1 generally outlines the duties of the CM and CQA Manager for major construction items.

E5.4.1 Construction Phase Inspections

The general activities for each phase of the project are outlined on the following pages:

Preconstruction

Preconstruction inspection activities of the CQA Manager include the following:

- Reviewing design criteria, drawings, and specifications associated with project activity;
- Reviewing any shop drawings received for conformance with drawings and specifications;
- Updating the work schedule;
- Review Subcontractor's work plan and hazard analysis;
- Checking for inconsistencies in the design drawings and specifications;
- Becoming familiar with the site and materials that are to be used in construction activities at each project activity;
- Reviewing the Contractor's SSHP as it applies to the PPE for each activity, special procedures, and the heavy equipment or machinery to be used in the performance of each task; and
- Soil testing for source prequalification.

Construction

The CQA Manager will follow the guidelines set forth in the specifications. The inspection activities of the CQA Manager include (1) observing the construction activities, (2) documenting compliance or noncompliance with the approved drawings and specifications, and (3) verifying the CQC procedures performed by the Contractor. Activities will include, but not necessarily be limited to, the following:

- Construction evaluation and testing;
- Inspection of the earth materials construction work;
- Verifying training records for personnel; and
- Ensure that all work is performed with proper safety permits following proper safety procedures.

Post-construction

Upon completion of construction, a post-construction inspection shall be conducted of the completed project by the CQA Manager to identify any areas that may require corrective attention by the Contractor. The CQA Manager will inspect the completed project for the following:

- Items that do not meet design specifications or criteria; and
- Results of a contractor-provided as-built survey to check that the project is completed as indicated on the drawings.

E5.4.2 Construction

The inspection activities of the CQA team include the following:

- Checking that each lift of the pads constructed to support equipment or other specified items is compacted to the specified relative compaction;

- Conducting independent tests on all fill materials to determine soil compaction and moisture curves, grain size, and soil characteristics, such as:

  - Sieve Analyses- Particle Size analysis and Hydrometer on each type of fill to check that the material being used conforms with the specified requirements. Additional tests shall be initiated whenever a change in material characteristics is observed in the opinion of CQA personnel.

  - Laboratory compaction tests will be initiated or performed by the Contractor, before starting the work necessary, to establish the maximum dry density and optimum moisture content of material to be used as fill. Modified proctor tests may be done on site or by an approved soil laboratory at the discretion of CQA personnel.

- Ensuring that fill and compaction work is performed during favorable weather conditions;

- Observing and/or testing fill material characteristics for gradation, excessive organic material, or other characteristics to check that it conforms with the specification;

- Measuring uncompacted lift thickness;

- Performing periodic in-place density tests to check that the specified relative compaction of each lift of the compacted soil cover is achieved; where specified relative compaction values are not achieved, the Contractor will be required to rework the area(s) in question; these areas will the be retested to check that the specified relative compaction levels are achieved;

- Observing the moisture content of the soil with periodic and scheduled moisture content tests conducted in the field;

- Identifying any material changes used in placing backfill material; and

- Observing site excavation, fill and backfill placement, and compaction to bring the material and topsoil to finish grades.

E5.4.3 Seeding and Mulching

The CQA team will inspect the grass seeding and mulching for the following activities:

- Identifying any depressions that would cause water to pond or slopes that are prone to erosion;

- Checking all permanent drainage structures near the backfilled areas for damage caused by construction activities;

- Conducting a final inspection of the grass four to six months after completion to locate any cracks, erosion areas, or depressions that would impact performance of the grass cover;

- Conducting a final inspection of the seeded area six months after germination to verify that the grass cover meets design criteria; and

- Ensuring provisions for the Contractor to return to the site if problems occur.

E5.4.4 Grading and Earth Work

The CQA team will inspect the backfilled areas of the landfills for the following:

- Low spots or depressions that would cause ponding water;

- Areas that are damages or improperly compacted;

- Areas that have been excessively eroded by rainfall during the construction period or as a result of construction activities;

- Large irregularities or protrusions resulting from rocks, sticks, cracks, and excess material placement; and

- Finished grade elevations on the basis of the post-construction "as-built" survey.

E6.0 QUALITY ASSURANCE

This section describes the objectives, procedures for tracking deficiencies, and documentation requirements of the quality assurance program.

E6.1 QUALITY ASSURANCE OBJECTIVES

The quality assurance objectives for the project include conducting the necessary observations, inspections, and reviews to assure that CQC procedures and requirements are properly implemented. Quality assurance is intended to ensure that the completed modifications achieve the performance criteria described in this CQA plan.

E6.2 GENERAL PROCEDURES FOR TRACKING DEFICIENCIES

Procedures developed for tracking any deficiencies identified by the CQA Manager will be implemented whenever significant conditions adverse to quality are identified. Tracking of nonconformances and dispositions including documentation of the root cause analysis and measures taken to prevent reoccurrence is the responsibility of the CQA Manager. Once corrective actions have been instituted, QA reports will reflect what actions were taken and certify that the resulting product meets requirements.

The CQA Manager will maintain a daily deficiency tracking log at the site which will be used to monitor the correction of plant modification deficiencies. A copy of this log is presented in Attachment 1.

E6.3 DOCUMENTATION

Documentation requirements of CQA activities are as described in the following sections.

E6.3.1 Submittals

The Contractor will coordinate the review and approval of the required submittals with the Engineering Task Manager or CQA Manager. The Contractor will provide submittals as required by the drawings and construction specifications. Submittals will be maintained in the Contractor's and USACE's project file.

E6.3.2 Daily Construction Reports

A construction report will be prepared on a daily basis for each day that construction activities occur at the Site. Supporting inspection or test data sheets and records of significant problems that occur or have occurred and what corrective measures were implemented will be attached to the daily construction report.

The daily construction report form will be prepared by the CQA Manager or his designee and will include the following:

- Name of CQA Officer, or his designee;
- Date, name of project, and location;
- Weather and Site conditions;
- Summary of construction activities, including progress;
- Record of equipment and personnel working in a particular area;
- Location of work being inspected or tested and areas passing final inspection;
- Description of any materials received at the Site and the condition in which they were received;
- Identification of construction problems or nonconformance and their solution or disposition;
- Identification of follow-up inspections of previously reported deficiencies; and
- Signature of the CQA Officer or his designee.

E6.3.3 Inspection Logbooks

Field inspections, observations, and testing will be recorded in logbooks maintained by the CQA Manager. Observations in the field may take the form of notes, charts, drawings or sketches, photographs, or any combination of the above media. The logbooks will include the following information:

- Description, title, and date of the inspection activity;
- Location of the inspection activity;
- Standard test method used or type of inspection activity;
- Recorded observation and/or test data, with all calculations completed and checked;
- Comparison of test results and observations with construction specifications requirements;
- Names and titles of persons involved in the inspection activity;
- Records of any material or workmanship that does not meet specified designs; and subsequent records of corrective action measures and the results; and
- Signature of appropriate CQA inspection personnel.

E6.3.4 Forms

Rust may propose modifications to the USACE Daily Quality Control Report form as appropriate to fit the special circumstances of individual situations. This and other forms which may be used are included in Attachment 1.

E6.3.5 Problem Identification and Corrective Measures Report

The problem identification and corrective measures report will be prepared by the CQA Manager and approved by the USACE Project Manager for every situation where a deviation from the approved design drawings or technical specifications occurs, either as a result of a necessary revision in design or materials of defective construction. The report will include the following information:

- Report identification number, date, and other identifying information;
- Name of person who identified the problem;
- Detailed description of the problem, including location and probable cause;
- How and when the problem existed;
- Estimate of how long the problem existed;
- Selected corrective measures;
- Documentation that corrective measures were implemented;
- Final results of corrective measures;
- Suggested methods to prevent similar problems;
- Reference to inspection data sheets;
- Name and signature of the CQA;
- Name and signature of the Engineering Task Manager; and
- Name and signature of the USACE Project Manager.

E6.3.6 Monthly Construction Progress Report

The Contractor will prepare a monthly construction progress report for submittal to the USACE by the end of each month. The construction progress reports will summarize construction activities at the Site for the previous reporting period. These progress reports will include the following:

- A summary of results of sampling, testing, laboratory analysis, and other data received during the course of the work that passed QA/QC procedures, as well as copies of daily construction reports and inspection reports;

- A description of deviations from the approved work plans, drawings, or construction specifications;

- A description of problems or potential problems encountered during the reporting period and actions taken or being taken to rectify problems;
- A description and estimate of the percentage of construction activities completed, including unresolved delays encountered or anticipated that may affect the project schedule;
- A description of the projected work, including documents to be submitted during the next reporting period; and
- A description of any changes in personnel.

E6.3.7 Document Control and Storage

During construction, the CQA Manager will be responsible for maintaining and organizing CQA documents for easy access by the USACE, and their representatives in the Engineer's field office. The CQA Manager will be responsible for keeping duplicate records of all documentation at the Engineer's field office. Furthermore, the CQA Manager will be responsible for incorporating any revisions to the CQA Plan and distributing revised copies to the subcontractor and other relevant parties.

E6.3.8 Final Inspection and Documentation

Following construction activities, any deficiencies in the components of the landfills will be identified in the final inspection. Participants in the final inspection will include the USACE's Project Manager, the Contractor, the Engineering Task Manager, DECAM, and the CQA Manager. If the final inspection uncovers any deficiencies, the deficiencies will be included in a punch list developed specifying the outstanding items requiring completion or correction before acceptance of work. A Construction Completion Report will be prepared and submitted to the USACE after completion or correction of the items identified during the precertification and any subsequent inspections.

The report will certify that the landfill cap is complete, and that it is consistent with the design drawings and specifications. The report will include the following elements:

- Synopsis of the cap construction;
- A construction chronology including photographs;
- Description of any modifications to design drawings and specifications;
- A list of construction inspection reports;
- Precertification and subsequent certification inspections ;

- As-built drawings;
- QC and QA control inspection reports, testing results, and surveys; and
- Certification that the cap is complete.

E7.0 ACCEPTANCE AND MODIFICATION OF CONSTRUCTION QUALITY ASSURANCE PLAN

E7.1 ACCEPTANCE OF CONSTRUCTION QUALITY ASSURANCE PLAN

This CQA Plan prepared for the Landfills 2, 5, and 6 caps will be approved by USACE prior to initiation of construction activities. Acceptance will be conditional and predicated on satisfactory performance during all operations. Rust acknowledges that the USACE reserves the right to require Rust to change the CQA Plan including removal of personnel if required to obtain the desired quality. Prior to acceptance of the CQA plan, Rust will meet with the USACE in a QA Coordination Meeting and discuss the plan. This discussion will include a review of the following:

- Forms to be used to document QA activities;
- Control activities;
- Testing;
- System administration; and
- Coordination with USACE quality assurance activities.

Minutes of this meeting will be prepared by Rust, and Rust will be expected to sign off on these minutes together with USACE. Rust also acknowledges that review of the plan will be an on-going process throughout the duration of the delivery order and it may be modified with mutual agreement.

E7.2 MODIFICATION OF CONSTRUCTION QUALITY ASSURANCE PLAN

Rust will submit written notification, through a serial letter, to USACE regarding addenda or modifications to the CQA Plan for approval or disapproval. This will be done within seven days prior to any proposed change and implementation will not occur without prior USACE approval. Rust acknowledges that any proposed changes are subject to acceptance by the USACE Project Manager.

E8.0 SECURITY, EMPLOYEE INDOCTRINATION, AND PERMITS

All employees assigned to work on this contract will follow all security requirements of Fort Carson. All employees of Rust and it's subcontractors will be informed of the rules and regulations of Fort Carson before they begin work.

E9.0 REFERENCES

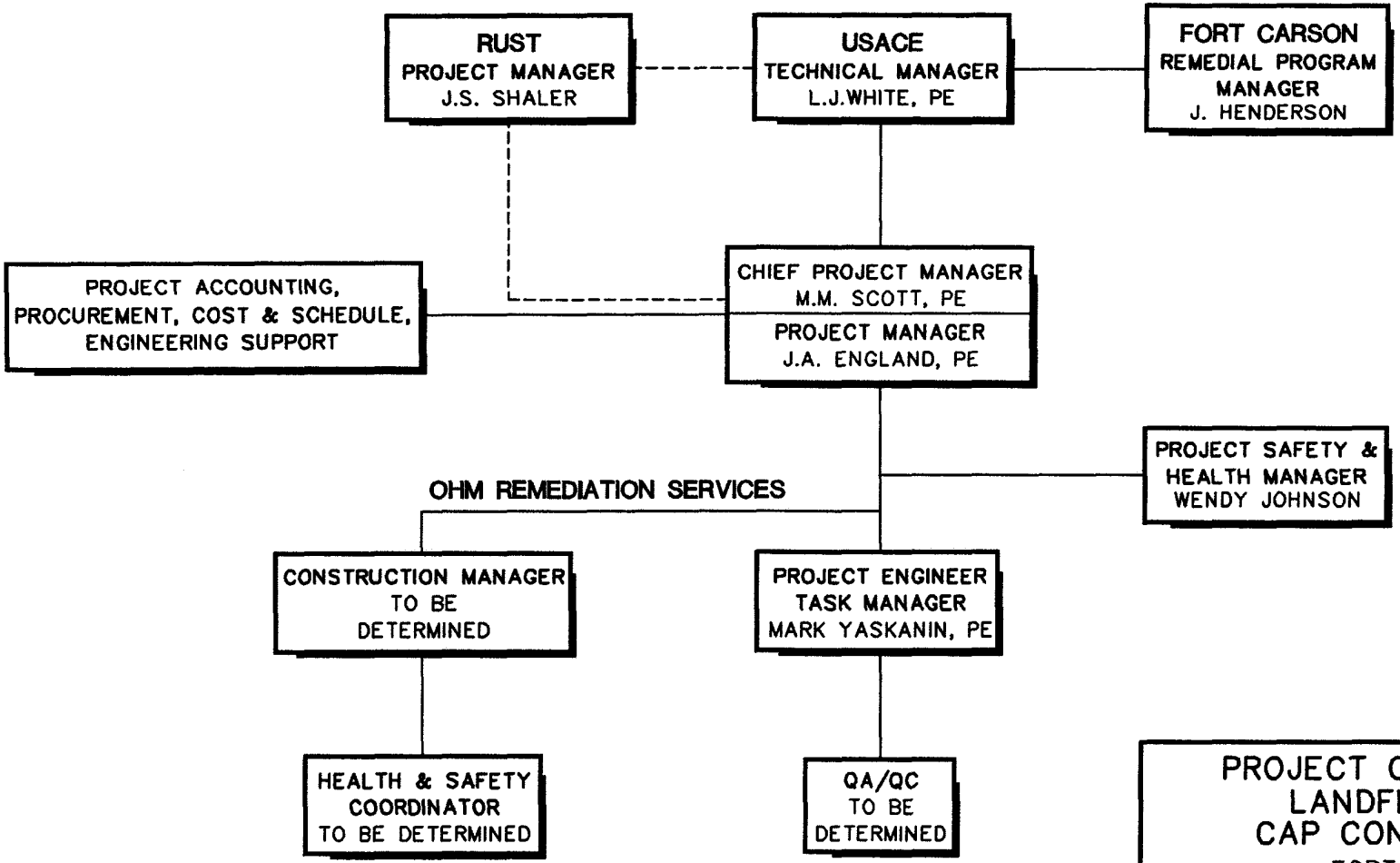
American National Standards Institute/American Society for Quality Control. Quality System Requirements for Environmental Programs, Draft. ANSI/ASQC E4-1993, May 1993.

U.S. Army Corps of Engineers Sample Contractor Quality Control Program.

Central Weld Sanitary Landfill, Final Cover Construction Quality Assurance Plan, November 1994.

FIGURES

CHECKED BY	APPROVED BY	DRAWN BY EMH	DATE 11\14\95	FILE NAMEFTCARSON\ORGCHART.DWG	REVISION NO. 0



PROJECT ORGANIZATION
LANDFILL 2,5&6
CAP CONSTRUCTION

FORT CARSON
COLORADO SPRINGS, COLORADO

PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS

RUST ENVIRONMENT & INFRASTRUCTURE

ATTACHMENT E-1

QA AND QC FORMS

LIST OF FORMS

Daily Quality Control Report

Preparatory Phase Meeting Checklist

Initial Phase Inspection Checklist

Deficiency Tracking Log

Quality Control Test Requirements

Government Equipment Inventory Record - Accountable Property

Government Equipment Inventory Record - Non-Accountable Property

Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's

Certificates of Compliance

Request for Information/Clarification

Request for Information Log

Subcontractor's Daily Report

Statement of Compliance

Statement of Acknowledgment

Change Order

Change Order Log

Contractor's Serial Letter Log

COE Serial Letter Log

Inspection Report

Test Report

Submittal Register

Excavation Permit

Individual Property Pass

RUST
DAILY QUALITY CONTROL REPORT

Page ___ of ___

REPORT #	Date:	Day:
CONTRACT #		
WEATHER CONDITIONS	Project Title:	
Precipitation: inches / Temperature		
Wind: / Min.	Project Location:	
Max.		

1. Contractor/Subcontractors and areas of responsibility:

TASK	WBS	JOB DESCRIPTION/ TRADE	4 EMPLOYERS	EMPLOYER	TOTAL HOURS

MANHOURS WORKED _____ TOTAL TO DATE _____

Comments:

2. Operating Plant or Equipment (Not Hand Tools)

Plant/ Equipment	Date of Arrival/Departure	Date of Safety Check	Hours Used	Hours Idle	Hours Repair

COMMENTS:

3. Work Performed Today: (Indicate location and description of work performed by prime and/or subcontractors.

4. Control Activities Performed:

Preparatory Inspections: (Identify feature of work and attach minutes.)

Initial Inspections: (Identify feature of work and attach minutes.)

Follow-Up Inspections: (List inspections performed, results of inspection compared to specification requirements and corrective actions taken when deficiencies are noted.)

5. Test Performed and Test Results: (Identify test requirements by paragraph number in specification and/or sheet number in plans.)

6. Material Received: (Note inspection results and storage provided.)

7. Submittals Reviewed:

(a) Submittal No.	(b) Spec/Plan Reference	(c) By Whom	(d) Action

8. Offsite Surveillance Activities, Including Action Taken:

9. Job Safety: (See Attached Daily Safety Briefing.)

10. Remarks: (Instructions received or given. Conflict(s) in plans and/or specifications. Delays encountered.)

CONTRACTORS VERIFICATION:

On behalf of the Contractor, I certify this report is complete and correct and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

RUST QC System Manager _____ Date _____

RUST
(FIRM NAME)

PREPARATORY PHASE MEETING CHECKLIST

Contract No.: _____ Date: _____
Project Title & Location: _____
Specification Section and Paragraphs referenced: _____
Contract Drawings referenced: _____

A. Personnel Present:

Name	JOB TITLE	COMPANY

Are appropriate personnel attending this meeting including field superintendent/foremen/subcontractor? YES_____ NO_____
If not cancel meeting and reschedule.

B. Name of the Quality Control Staff member responsible for verifying that all materials has or will be checked against approved submittals and that all work complies with contract requirements.

_____

C. Is required insurance submitted or on file as required prior to start work? YES_____ NO_____

D. Is Subcontractors SF 1413 and certificate of Insurance submitted prior to start of work?
YES_____ NO_____

E. Have all submittals requiring approval prior to start of work been approved with minimum "C" action? YES_____ NO_____
If NO cancel meeting and reschedule.

SUBMITTAL SPEC/PARA	DESCRIPTION	ID NO & ACTION

F. The following are submittals required prior to close out.

_____
_____
_____

G. Are all materials on hand and have they been checked for contract compliance?
YES_____ NO_____

If not explain: _____

_____

_____

List items not in accordance with submittals and contract specifications:

_____

_____

_____

H. Has each Spec. Paragraph, drawing, submittal and procedure for accomplishing the work been studied and reviewed with appropriate personnel? YES_____ NO_____

I. Has all preliminary work been accomplished in accordance with contract requirements and is this segment of work ready to start? YES_____ NO_____

J. Test required in accordance with contract requirements: Include Spec. paragraph, frequency and responsible party.

_____

_____

_____

_____

_____

K. Has Hazard Analysis plan been reviewed and is it acceptable? YES_____ NO_____

L. Comments and/or explain any problems:

_____

_____

_____

_____

_____

_____

M. Has the Rocky Mountain Repetitive Deficiency list been reviewed? YES _____ NO _____

_____

QUALITY CONTROL SYSTEM MANAGER

RUST
(FIRM NAME)

INITIAL PHASE INSPECTION CHECKLIST

Contract No.: _____ Date: _____
Project Title & Location: _____
Specification Section and Paragraphs referenced: _____
Contract Drawings referenced: _____

A. Personnel Present:

Name	JOB TITLE	COMPANY

B. Exact location of work inspected: _____

C. Are materials being used in strict compliance with plans and specifications? YES____ NO_____

D. Are procedures and/or work methods in strict compliance with contract plans and specifications?
YES _____ NO _____ If not, explain _____

E. Is workmanship acceptable? YES _____ NO _____
If not, state areas where improvements are needed: _____

F. Safety Violations and corrective actions to be taken: _____

G. Remarks: _____

QUALITY CONTROL STAFF MEMBER

QUALITY CONTROL SYSTEMS MANAGER

USACE REPRESENTATIVE

MASTER DEFICIENCY TRACKING LOG (MaDTaG)

LOG NO.	DATE FOUND	INDENT. BY (NAME)	DESCRIPTION OF DEFICIENCY	LOCATION OF DEFICIENCY	CORRECTIVE ACTION TAKEN	CORRECTION DATE REQ'D / ACT	CORRECTION VERIFIED CQC / QA
			Category No. __				
			Category No. __				
			Category No. __				
			Category No. __				
			Category No. __				
			Category No. __				

QUALITY CONTROL TEST REQUIREMENTS

Citation Reference	Type of Test	Method	Frequency/Estimated Quantity	Responsible Person/Lab

Contract No._____

GOVERNMENT EQUIPMENT INVENTORY RECORD

ACCOUNTABLE PROPERTY

Item/Manufacturer: _____

Model: _____

Model No.: _____

Serial No.: _____

Decal No.: _____

Acquisition Cost (tax & shipping included): _____

Date Received: _____

Furnished or Acquired: _____

Maintenance Cost: _____

Date Issued	Site Location	Project No.	Calibration Date	Date Returned	Condition Code	Comments

Contract No._____

GOVERNMENT EQUIPMENT INVENTORY RECORD

EXPENDABLES

Item: _____

Type: _____

Unit Price: _____

Quantity Rec'd	Quantity Issued	Balance On Hand	Location	Project No.	Date Issued	Comments

Contract No. _____

GOVERNMENT EQUIPMENT INVENTORY RECORD

NON-ACCOUNTABLE PROPERTY

Item/Manufacturer: _____

Model: _____

Model No.: _____

Serial No.: _____

Decal No.: _____

Acquisition Cost (tax & shipping included): _____

Date Received: _____

Furnished or Acquired: _____

Maintenance Cost: _____

Date Issued	Site Location	Project No.	Calibration Date	Date Returned	Condition Code	Comments

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE

TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. (Cover only one section with each transmittal)	PROJECT TITLE AND LOCATION		

ITEM NO. a.	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* b.	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE g.	VARIATION *(See instruction No. 6)* h.	FOR CE USE CODE i.
				SPEC. PARA. NO. e.	DRAWING SHEET NO. f.			

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated.

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

	REQUEST FOR INFORMATION/ CLARIFICATION **FOR** **PUDA**	IFR/C NO:
TO:		CONTRACTOR/SUPPLIER DISTRIBUTION:
	DRAWING LOCATION SPEC. PAGE:	
TITLE OR SECTION OF WORK:		
COST EFFECT:	ISSUED BY: DATE:	

WRITTEN DESCRIPTION OF PROBLEM -- ATTACH SKETCHES AS REQUIRED:

PROPOSED SOLUTION

BY: _____ DATE: _____

DISTRIBUTION: ☐ USACE ☐ ENGINEER ☐ OWNER ☐ MECHANICAL ☐ ELECTRICAL ☐ STRUCTURAL

RFI #	Date Out	Subject	Date Back
001			
002			
003			
004			
005			
006			
007			
008			
009			
010			
011			
012			
013			
014			
015			
016			
017			
018			
019			
020			
021			
022			
023			
024			
025			
026			
027			
028			
029			
030			

Subcontractor's Daily Report

SUBCONTRACTOR _____

PROJECT _____ DATE _____

LOCATION AND DESCRIPTION OF WORK BEING PERFORMED:

COORDINATION OR SCHEDULE PROBLEMS FOR SUPERINTENTENT'S ATTENTION:

DISCREPANCIES NOTED IN PLANS OR SPECIFICATIONS: REQUESTS FOR CLARIFICATION OR WORK ORDERS.

SUBCONTRACTOR'S WORK FORCE		
CRAFT	JOURNEYMEN	APPR.

EQUIPMENT:

Complete, sign and submit to RUST Environment & Infrastructure no later than 10 a.m. of day following date of report. Include full description of any event or circumstance for which subcontractor may expect to claim additional time or compensation.

BY _____

(Signature of Subcontractor's Representative)

STATEMENT OF COMPLIANCE

PAYROLL NUMBER	PAYROLL PAYMENT DATE	CONTRACT NUMBER

Date _____

I, _____ (Name of signatory party), _____ (Title) do hereby state:

(1) That I pay or supervise the payment of the persons employed by _____ (Contractor or subcontractor) on the _____ (Building or work); that during the payroll period commencing on the _____ day of _____, 19 ____ and ending the ____ day of _____, 19 ____, all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said _____ (Contractor or subcontractor) from the full weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 *(29 CFR Subtitle A)*, issued by the Secretary of Labor under the Copeland Act, as amended *(48 Stat. 948.63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:*

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ - In addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ - Each laborer or mechanic listed in the above referenced payroll has been paid as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION *(Craft)*	EXPLANATION

REMARKS

NAME AND TITLE	SIGNATURE

The wilful falsification of any of the above statements may subject the contractor or subcontractor to civil or criminal prosecution. See Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

DD FORM 1 NOV 68 879 PREVIOUS EDITIONS ARE OBSOLETE.

STATEMENT AND ACKNOWLEDGMENT

FORM APPROVED OMB NO. 3090-0119

PART I – STATEMENT OF PRIME CONTRACTOR

1. PRIME CONTRACT NO.	2. DATE SUBCONTRACT AWARDED	3. SUBCONTRACT NUMBER

4. PRIME CONTRACTOR *(Name, address and ZIP code)*	5. SUBCONTRACTOR *(Name, address and ZIP code)*

6. The prime contractor states that under the contract shown in Item 1, a subcontract was awarded on date shown in Item 2 by (Name of Awarding Firm) _____

_____

to the subcontractor identified in Item 5, for the following work:

7. PROJECT	8. LOCATION

9. NAME AND TITLE OF PERSON SIGNING	10. BY *(Signature)*	11. DATE SIGNED

PART II – ACKNOWLEDGMENT OF SUBCONTRACTOR

12. The subcontractor acknowledges that the following clauses of the contract shown in Item 1 are included in this subcontract:

Contract Work Hours and Safety Standards Act – Overtime Compensation – Construction	Davis-Bacon Act
	Apprentices and Trainees
	Compliance with Copeland Regulations
Payrolls and Basic Records	Subcontracts
Withholding of Funds	Contract Termination-Debarment

13. NAME(S) OF ANY INTERMEDIATE SUBCONTRACTORS, IF ANY

14. NAME AND TITLE OF PERSON SIGNING	15. BY *(Signature)*	16. DATE SIGNED

ISN 7540-01-151-4297
413-101

☆ U.S. GOVERNMENT PRINTING OFFICE: 1984 437-223/6348

STANDARD FORM 1413 (10-83)
Prescribed by GSA
FAR (48 CFR) 53.222(e)

CHANGE ORDER NO. _____

Owner _____ Date _____

Project _____

Owner's Contract No. _____ Contractor _____

Date of Contract Start _____ $_____

You are directed to make the following changes in the Contract Documents.
Description:

Reason for Change Order:

CONTRACT PRICE		CONTRACT TIMES (Calendar Days)		
			To Subs. Completion	To Final Completion
Original:	$_____	Original:	_____	_____
Previous C.O.s (ADD/DEDUCT):	$_____	Previous C.O.s (ADD/DEDUCT):	_____	_____
This C.O. (ADD/DEDUCT):	$_____	This C.O. (ADD/DEDUCT)	_____	_____
Contract Price with all approved Change Orders	$_____	REVISED:	_____	_____
		Orig. Compl. Date:	_____	_____
		Rev. Compl. Date:	_____	_____

It is agreed by the Contractor that this Change Order includes any and all costs associated with or resulting from the change(s) ordered herein, including all impact, delays, and acceleration costs. Other than the dollar amount and time allowance listed above, there shall be no further time or dollar compensation as a result of this Change Order.

THIS DOCUMENT SHALL BECOME AN AMENDMENT TO THE CONTRACT AND ALL STIPULATIONS AND COVENANTS OF THE CONTRACT SHALL APPLY HERETO.

RECOMMENDED:

By: _____ Date _____
Engineer (Authorized Signature)

By: _____ Date _____
Owner (Authorized Signature)

By: _____ Date _____

Change Order Log

Owner: _____ Contract: _____ Project No: _____

Project: _____ Contractor: _____ Page ____ of ____

C.O. No.	Change Order Description	C.O. Amount	Transmit C.O. to Contr.	Transmit C.O. to Owner	C.O. Rec'd. from Owner	Eng. to Funding Agency	Date Approved	Eligible C.O. $	Incl. C.O. $

CONTRACTOR'S SERIAL LETTER LOG

Contract No. - DACA_____

_____

Contractor's Serial _____ to _____

Inclusive Dates _____ to _____

Serial No.	Date Received	Subject (In Brief)	Reply Suspense	Action Office	COE Reply Ltr. No.	Reply/Remarks

COE SERIAL LETTER LOG

Contract No. - DACA_____

_____

Contractor's Serial _____ to _____

Inclusive Dates _____ to _____

Serial No.	Dated	Subject (In Brief)	Reply Suspense	Action Office	Reply to Cont. Ltr.#	Reply/Remarks

INSPECTION REPORT

PREFINAL FINAL DATE: _____
(Circle One)

CONTRACT NUMBER: _____

PROJECT TITLE: _____

NAME	ORGANIZATION/COMPANY

	DISCREPANCIES NOTED	DATE CORRECTION MADE
1.		
2.		
3.		
4.		
5.		

_____ _____
RUST Representative Date Corps of Engineers Representative Date

_____
Pueblo Depot Activity Representative Date

TEST REPORT

Project: _____

Contract Number: _____

Date: _____

Contractor: _____

Date of Test: _____

System Tested: _____

Type of Test: _____

Duration of Test: _____

Test Pressure: _____

Test Remarks: _____

_____

_____

_____

Other Data: _____

Subcontractor's QC: _____

Quality Control Supervisor: _____

Witnessed By: _____

SUBMITTAL REGISTER

NAME AND LOCATION	CONTRACTOR	CONTRACT NUMBER

SPECIFICATION SECTION

NAS ACTIVITY CODE *a*	TRANS-MITTAL AND ITEM NO. *b*	SPECIFICATION PARAGRAPH NUMBER *c*	DESCRIPTION OF ITEM SUBMITTED *d through n*	CLASSI-FICATION *o*	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS *x*
					SUBMIT *p*	APPROVAL NEEDED BY *q*	MATERIAL NEEDED BY *r*	CODE *s*	DATE *t*	SUBMIT TO GOVERN-MENT *u*	CODE *v*	DATE *w*	

Classification GA1: Government Approved-Category I GA2: Government Approved-Category II FIO: For Information Only

EXCAVATION PERMIT

(TEAD-4 420-16)

Proponent agency is Depot Facilities Division

Excavation Requested By: _____

Location of Excavation: _____

Date of Excavation: _____

Based upon drawings available and personal knowledge, I believe the area of excavation is free of underground facilities, over which I am responsible, except as hereon noted and staked at excavation site.

_____	_____	_____
Electrical	Mechanical	Communications
_____	_____	
Sanitation	Utilities Branch/Services Branch	

This permit to be completed and attached to the work order, prior to the work order being issued.

Excavator must have a valid permit in his possession before and during excavation.

(See Privacy Act Statement on reverse)

INSTALLATION AND/OR BUILDING	TYPE OF PASS ☐ TEMPORARY ☐ PERMANENT	DATE ISSUED
NAME OF BEARER	BADGE OR SERVICE NO.	DATE EXPIRES

BEARER IS AUTHORIZED TO ☐ REMOVE FROM ☐ CARRY ONTO PREMISES ☐ GOVERNMENT ☐ PERSONAL PROPERTY DESCRIBED BELOW:

BRIEFCASE(s) *(number)*	SUITCASE(s) *(number)*	PACKAGE(s) *(number)*	OTHER *(Specify)*

CONTAINING *(Continue on reverse side)*

TYPED NAME, GRADE OR TITLE	SIGNATURE

DA FORM SEP 82 1818 EDITION OF 1 SEP 56 MAY BE USED.

INDIVIDUAL PROPERTY PASS
For use of this form, see AR 210-10; the proponent agency is TAGO.

DATA REQUIRED BY THE PRIVACY ACT OF 1974

AUTHORITY:	10 USC 4832.
PURPOSE:	Used to identify military and civilian personnel who are authorized to remove or carry onto an installation, Government or personal property. DA Form 1818 can be used as a temporary or permanent pass.
ROUTINE USES:	Information is not disclosed outside of DOD.
MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION:	Individual will not be authorized to remove from/carry on Government or personal property if information is not provided.

CONTAINING *(Continued)*

Reverse of DA Form 1818, Sep 82

*U.S. GPO: 1989-242-450/02459

ATTACHMENT E-2

LIST OF ANTICIPATED TESTS

DRAFT DOCUMENT

GUIDANCE RECOMMENDATIONS[1] FOR CONSTRUCTION QUALITY CONTROL TESTING OF FINAL COVER BARRIER LAYER COMPONENTS FOR SOLID WASTE LANDFILLS

TESTING	FREQUENCY
Atterberg Limits (liquid limit and plasticity index - ASTM 4318)	One per material type, or One per 3,000 cubic yards
Sieve - Grain Size (ASTM D422 or D1140)	One per material type, or One per 3,000 cubic yards
Permeability (ASTM 5084)	One per material type, or One per 5,000 cubic yards
Density - Nuclear Gauge (ASTM D2922) Moisture - Nuclear Gauge (ASTM 3017)	One per 300 cubic yards* One per 300 cubic yards*
Modified or Standard Proctor Curve (as appropriate) Moisture vs. Density (ASTM D698 or D1557)	One per material type, or One per 3,000 cubic yards
Oven Dried Moisture Content (ASTM D2216 or D4643)	One per 1,500 cubic yards*
Sand Cone Density (ASTM D1556)	One per 15,000 cubic yards
One-Point Proctor (ASTM D698 or D1557)	One per material type*

* As a minimum, the following tests should be performed once per day for each day that material is placed:
1. Nuclear moisture and density tests.
2. Oven dried moisture content.
3. One point proctor.

[1] Guidance provided by the Colorado Department of Public Health and Environment.